British Society for the Study of Orthodontics

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TRANSACTIONS

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HEADQUARTERS

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CONTENTS

	Page
Officers and Councillors, 1949	4
Past Officers	5
List of Members, 1949	7
Notes to Readers of Papers	12
Multum in Parvo—L. Russell Marsh	13
Serial Models of a Case Treated by the Extraction of the Four First Permanent Molars—K. E. Pringle	23
Some Observations on the Growth of the Alveolus in Man—W. Russell Logan	27
An Unerupted Canine in a Man Aged 70—Harold Chapman	36
May Demonstration Meeting:—	
Correcting the Results of Early Loss in the Lower Arch—J. D. Hooper	38
Three Demonstrations—M. A. Kettle	39
A Working Model to Aid in Teaching Orthodontic Diagnosis—J. H. Hovell	42
Some Interesting Cases—Joan Ritchie	42
Some Orthodontic Procedures—Rosamund Caseley	46
A Band Forming Pliers—R. Ernest Rix	48
The Modified Arrowhead Clasp—C. P. Adams	50
Demonstrations by Orthodontic Department of Liverpool Dental School	50
Congenital Absence of Permanent Molars—Muriel E. H. Davies	53
Treating Cases with Removable Appliances—J. R. Dimock	57
An Apparatus for Lateral Radiography—J. D. Hooper	61
A Craniostat and Its Uses—P. D. Priest	65
Lip Exercises—H. E. Wilson	68
The Third Northcroft Memorial Lecture—The Fixation and Stability of the Teeth in the Jaws with Relation to their Morphology—Professor R. Selmer-Olsen	72
A Case of Micrognathia and Microglossia—R. B. Dockrell	90
Animal Genetics and Orthodontics—Dr. Hans Gruneberg	93
Reports of Meetings	104
Accounts, Income and Expenditure	114
Balance Sheet	115
Index	117

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MULTUM IN PARVO

By L. RUSSELL MARSH, F.D.S. R.C.S. Eng.

IT OCCURS TO ME THAT IN OUR HISTORY we have been addressed on all subjects relating to our specialty, on teeth, growth, muscles, bones, arch relationship and appliances. But no one has thought to talk to us about the child "all in one piece." And most successful orthodontists do know a great deal about children. They are men, and women, who have a special charm, of which they are totally unaware, but which children, who are the best of all judges, recognise at once. I am proud to know that there is a very high concentration of this special charm in our Society, and in our specialty at large, for a man cannot work with children continually, without being influenced by them, and to be influenced by children is something to be thankful for.

Having now put you all into good humour, I can proceed with more confidence. That my remarks may appear, to the elite of the Society, to be redundant, I am prepared to accept, for such would be the case of any remarks I could make. I hope they will bear with me, if I address our less experienced colleagues, in the hope that something I may say may appear to be instructive. I am like the amateur composer who asked Rossini's opinion of his work. Rossini said, "Some of it is good, and some of it is new. But what is new is not good, and what is good is not new."

Everything, I am told, has been said already. But as nobody ever listens, there is no harm in repeating it.

In the profession of dentistry as a whole, we have an unique privilege, which is not always appreciated by our younger members. No other profession has the opportunity of earning the gratitude, and even the friendship, of complete strangers in a short time. It takes us ten minutes, fifteen minutes, or half an hour to put a patient out of his pain, and this by doing our ordinary job in the ordinary normal way : and we are overwhelmed with gratitude, as well as being paid for our services. In less urgent cases, merely by gently handling and a little natural kindness, we can earn the same sort of gratitude. We don't deserve it, we are only doing our job. The least we can do is to try, by unstinting care and effort, to be worthy, in some small measure, of the good opinion we so easily inspire.

And so with children, only with greater joy, and even more gratifying response. There are expert technicians, I know, who regard patients merely as impersonal objects of their craft, not as human beings at all. These fellows ought to be building motor-cars. Orthodontics is more than a technical job, more than a biological study ; it is a human responsibility, not only for the successful conclusion of a case, but for the comfort and happiness of a child, during and after treatment. With our skill we can change a child's whole outlook on life, but the real importance of that success is to the child's happiness, not to our records.

Just to emphasise my point, let us look back at some of the great orthodontists of the past—George Northcroft, Cale-Matthews, Badcock, Visick to mention only four. Those men were brilliant orthodontists, great men, but more than that, they were *great children's men.*

To return to our lambs. To tell a man how to deal with children, is like telling him how to be fascinating at a cocktail party. You just can't. It is up to him personally. But if you can help him to understand them, you will have achieved something.

If I were addressing students I should say :—

" If you want to specialise in orthodontics, first study children and then study orthodontics. If you want to be a general practitioner, learn how to handle children, and you will know how to handle grown ups." Personally I have a feeling of overwhelming gratitude towards my little patients. If I have achieved anything at all in our specialty, if I have obtained any results worthy of the label " success," it is with their help, their endurance and their loyalty. Without that I could have done little or nothing.

Prof. Friel, in his recent excellent Presidential address to the R. S. M., urged us, before making our diagnosis, to study the whole child, and not only the mouth. I would lay particular emphasis upon the personality of the child and its background. Either you are going to make friends with that child, or you are going to have an uphill fight all the way, with a good possibility of failure, whatever your technical competence, and however easy a case it may be. Fortunately youngsters are very ready to make friends, and, generally speaking, are quite prepared to like you, provided that they have no cause to mistrust you. Fortunately, again, our work is not usually painful. But it is essential never to let the child down, always to warn it when something is likely to be especially uncomfortable. If pain occurs unexpectedly, an immediate apology from one gentleman to another is generously accepted, and is very sound policy. The whole treatment should be a sort of partnership, as indeed it must be, in which the patient understands the immediate, as well as the ultimate aim. Lecturing young children is usually hopeless. They just don't listen. A friendly talk may be necessary, by the assumption of an existing situation rather than emphasis on Duty. Such an expression as, " this is for your own good," cuts no ice at all, and neither does the suggestion that a little girl is anxious to grow up to be a beautiful young lady. At the age of eight years she probably does not care two hoots whether she is going to be a beautiful young lady or not.

Children, particularly young children, are like thoroughbred animals, they are easily startled by sudden noises, and do not like rush and bustle. They have no sense of time, and an atmosphere of hurry distresses and tends to frighten them. An anaesthetist friend of mine, who is a great children's man, tells me that he has observed that people with loud voices do not go down well with children, and that this also applies to the bustling type who are always in a hurry. An atmosphere of nonchalance is his technique, and in dealing with young children he is a joy to watch.

Anaesthetists, who do dental work, always excite my admiration, for whereas we have endless time in which to make friends and to gain the confidence of the patient, they have about five minutes, and that, as you will admit, on a most difficult occasion. My friend also tells me that his job is always easier if the dentist is a children's man.

We should always behave simply with children. Children do not like affection. (The schoolmaster who tries to curry favour and court popularity is often despised, while the sincere and just master, however stern he may be, is always popular). In advising you to be yourself, I hasten to assure you that, if, as in the case of your President, Nature has endowed you with a homely appearance and an unexciting personality, so much the better. Children like homely people, so don't try to improve upon it. After all, you do not put on a false moustache. Why put on a false manner, which will have the same effect ? Children suspect anything artificial, from histrionics to too much lipstick (a thing I very seldom use).

It is a good principle not to have the parent in the surgery, as a general routine. This is essential in ordinary dentistry, in orthodontics it is desirable. Personally, I find that the presence of a parent, or any third party, always rather cramps my

style. I find it difficult to be quite natural with a kiddy in the presence of an audience —in a small degree it is like being on the stage, or on this rostrum. And, of course, with two people to entertain, one's attention is divided. But, apart from that, you find yourself talking to the parent across the child's head, and that is bad, for you never get to know the child, or to establish that personal relationship which is so helpful to success. And besides, it is a great disappointment. That child goes through life having grown-ups talking over its head, and, if there is one pleasure in going to the dentist, it is the pleasure of having a grown-up all to itself, to be the centre of attention, and to feel important enough to talk man to man with someone older. It may sound a small matter, but I have found it important in many cases, and the children with whom I have formed what one might call life-long friendships, have usually been those who have not been accompanied in the surgery. I have reached an age when a number of those children are now mothers and fathers themselves, and their loyalty, however misguided, is very pleasing. Incidentally, you will be relieved to hear that, with all this chatter, I sometimes manage to get some work done too.

Children suffer from self-consciousness, not so much to-day perhaps as in years gone by, but some suffer more than others, and often quite acutely. One should remember this. It is another important reason why we should strive to attain a relationship of easy cameraderie, for it is important to break down that self-consciousness, which can inflict immeasurable torment. Incidentally, in our small way, we may be doing our little friends a great service, by beginning the cure of an affliction. In any event, it is wise to be patient with the shy child, for brusqueness, or impatience with his apparent stupidity, only makes him curl up.

There is a problem that worries me quite a bit in connection with the present day child, and that is the question of untruthfulness, which seems to me to be more common to-day than it was years ago. However, my contemporaries assure me that I am looking back through rose-tinted spectacles, and they infer that I was probably no George Washington myself. Men, I am told, were deceivers ever, and the only difference I have observed in women is that they do it more convincingly, and that it starts at age '0'. Nevertheless, I am still astonished at the number of children who can look you straight in the eye and tell an unblushing fib, a performance in which I should have given myself away nine times out of ten. The best way to avoid the mutual embarrassment of discovering a lie—is to avoid the situation in which it may happen. It is usually obvious whether a child has been wearing an appliance or not, and I think it is better not to ask, thereby inviting an untruth, but to wait until one is quite sure, and then, explaining the evidence, make a simple statement of fact, and discuss why the appliance has not been worn. And now arises another difficulty. Having put oneself on a plane of friendship with the patient, to invoke parental assistance is rather in the nature of " sneaking." So the first one or two offences are strictly between " you and me," as it were. After that, if co-operation is no better, one should explain to the patient that Daddy or Mummy must be told, otherwise, we shall both be in trouble, as the treatment is not doing any good. The report is made in the presence of the child, not more censoriously than the occasion demands, and the matter is discussed in full. The patient will usually see the justice of this. If this course is unproductive, it is often better to suspend treatment, until the child is interested in and even anxious about, its personal appearance.

This brings me to another problem, the question of family discipline. Even in this country discipline varies tremendously from one family to another, and we occasionally meet the spoilt child who is quite hopeless from our point of view. If those psychologists who advocate self-expression in children had their way, orthodontics would come to a standstill, for children who are allowed to run wild would certainly not agree to any inconvenience, however slight, which we might seek to impose upon them. That, I think, is a headache for our successors. But on the whole, family discipline in this country

is good, though not severe, and children are inclined on the average to be sensible.

I have had occasion before now to draw attention to the difference between family discipline in this country and in countries in middle Europe. In the German family, for instance, discipline is quite severe, one might even call it martial, and, when a new method of treatment, as, for instance, the night treatment of Schwartz, emanates from this region, one may not be sure of quite such success in this country as can be claimed in a country where " disobedience " is an unknown word.

My personal experience of night treatment has been that not all patients are suitable. I have sometimes found that if an appliance is worn throughout the 24-hour period, co-operation may be 100%, but that, if it is left out during the day time, the little patient often forgets to wear it at night.

I am told that family discipline is more lax in some countries than it is in this, and I know that there are some parts of the world where orthodontists have a very special problem. This is a matter for profound consideration, when choosing the type of appliance to be used, and it is clear that, in certain parts of the world, it might be possible to conduct an orthodontic practice using mainly removable appliances. I mention this matter so that we shall understand one reason why modern methods of functional treatment are not universally adopted. Our colleagues in other countries may have difficulties to contend with, which we do not fully appreciate.

Psychology and Habits

So much has been talked about the psychological significance of thumb-sucking that the whole thing is getting badly out of focus. I will not embark upon a general discussion of child psychology, except to remark that with few exceptions sensible parents do not have to consult psychologists about their children ; but I must take up the challenge on the subject of bad habits. I was brought up in a family where the discipline was still Victorian, stern but not really unkind. I had a Nanny who was strict in the way of those times. If I had put my thumb into my mouth the action would have been accompanied by a sharp stinging pain in the region of my ear,—so I did not suck my thumb. It did not take any greater intelligence than mine, to appreciate the folly of sucking my thumb under such uncomfortable conditions. Nobody ever enquired whether my wishing to suck my thumb was due to a sex impulse, or to a father fixation ; and so far as I know, I have never suffered from nervous debility due to frustration. (I may have ! Perhaps that is what is wrong with me !) The only result I can record is a feeling of friendliness, and even affection, towards anybody who does not attempt to knock my head off every time I raise my hand to my mouth ; but even this is wearing off as time goes on. My particular habit was holding my breath, and sometimes my friends wonder why anybody ever stopped me ! I do not suggest that corporal punishment is essential for curing bad habits, although it is better than nagging, but I am not prepared to believe that with limited exceptions, any attempt to cure a habit is bad for the child. If a habit were causing a child to become a cripple in any other way than dentally, the parent would very soon do something about it, with the wholehearted support of the entire medcial profession. I think it all depends upon whether the habit is a matter for shame to the parents or not. If a child has a dirty habit—the parent always deals with it successfully ; if it scratches its head, the inference is so uncomfortable that it is stopped. Or a dangerous habit like crossing the eyes. But thumbsucking is a " pretty " habit, and is explained by some doctors as being necessary to the child's peace of mind. So it is almost fashionable, and is certainly not a matter of disgrace. Besides, it is far easier to leave it alone than to deal with it.

One thing I must add. Thumbsucking is natural at the suckling age, i.e., the first year of life. Any forcible restraint at this age may actually induce the habit later.

I am not without sympathy for this problem of habits, but I think it is a great pity that parents are discouraged from taking steps to prevent a deformity, and

I feel convinced that the attitude is a wrong one. There are cases, I know, of extreme difficulty (and cases for the psychologist), but most normal children could be corrected with a little firmness, if the parents were not beset with doubts and conflicting advice.

I think that the application of theoretical psychological principles to ordinary, normal, healthy children is unnecessary, misleading and harmful.

Child Study

I dislike the expression " child psychology " because it continually reminds me of an aspect of child study which is grossly overdone, and which might easily result in a greater sum total of damage than of good. I would prefer to call it " child understanding," and one cannot be too emphatic that each child is an individual with its own temperament and nature, who is worthy of our study as an individual. As in orthodontics, so in " child study " one cannot classify except for the purpose of conveying ideas, and one should do so only on a clear understanding that, all classification is arbitrary, and meant to be no more than a guide to the personal study of the individual. And so we are driven to use the misleading word " type," in order to portray some outstanding characteristics which are commonly seen in our surgeries.

Highly Strung Type

This is a misused expression which often is meant to convey a rather special artistic temperament ; a mother's way of making one aware that her child is quite different from any other child in the world. If this quality is mentioned repeatedly in the presence of the child itself, the orthodontist knows at once that, whatever trouble he may have with the patient, he certainly has to deal with a stupid parent. In such circumstances the term " highly strung " is synonymous with " spoiled," and the prognosis from the orthodontist's point of view is probably poor.

But the term is used by quite reasonable parents when the patient is not in the room, and then it probably means that the child has a rather nervous disposition. My experience with these nervous children has been that, if you make friends with them, they will often become most excellent patients. They are usually gifted with imagination and intelligence, a two-edged sword which magnifies their fears, but at the same time magnifies their potentialities for affection and intelligent co-operation. Their faculties generally are more acute than the average.

The Phlegmatic Type

Such children often make rattling good patients who will put up with all sorts of inconvenience, discomfort and even pain if they think it necessary. But it is a mistake to take advantage of their endurance, or even to assume that they cannot harbour private fears, for every now and again one meets with a degree of nervous anticipation, in that same child, which is quite surprising.

If the phlegmatic type of child happens to be uninterested in the work being done, it can become an obstructionist. But this is often a question of age, which I will discuss later.

The Apathetic Type

Is what one might call one of the phlegmatics who has no interest in anything at all, and it is surprising how little improvement can occur in a case of this kind, without there being any obvious disobedience on which one can put one's finger. This particular type of child is to be wooed and won, or you will never get anywhere. I remember, many years ago, Cale-Matthews drawing attention to the unemotional child with the " cold blue eye." I have met this type on one or two occasions but it is fortunately rare, and I can assure you that you never get anywhere with such a patient. In the chair it is apathetically obedient, and readily promises all the co-operation you ask. But, away from the surgery, you are aware that the child is deliberately antagonistic to everything you do. Removable appliances are not worn, and fixed appliances are immediately wrecked. There is always an explanation for the mishap, until, by regular occurrences, it eventually dawns upon the orthodontist and the parents that the long arm of coincidence has been stretched too far. So, beware of the cold blue eye !

The Histrionic Type

It is the most natural thing in the world for the young child to draw attention to itself, and to " show off." Some children retain this habit, whereas others gradually shed it, as they emerge from babyhood. I find myself in some difficulty in this matter. As the father of a family I feel that a tendency to histrionics, which is a form of exhibitionism, should be discouraged with all the weight of parental authority. But this is not the job of the orthodontist, and he finds that he can often get more co-operation by pandering to a weakness which he would not tolerate in his own house. Fortunately such children are interested in their appearance which is a great help. (This " showing off " is sometimes not immediately obvious to a stranger, if it is not overdone—it only dawns upon one gradually).

The Devoted Type

Is easy, of course. Such a child has a wealth of affection to bestow, and with a little encouragement becomes not only a friend, but a willing slave.

The Bouncy Type

This heading covers a large proportion of the very young patients who come to see us, but a certain number of the older children find it impossible to sit still for more than a few minutes together. With these one has to be kind but firm, and even so, they require endless patience. I think it is important to remember that perpetual motion is their normal state, and to avoid if possible, becoming irritated by their natural exhuberance.

A little less irksome are :—

The Chattering Type

Who talk incessantly from the moment they enter the surgery. Sometimes the tendency to chatter is an indication of some underlying nervousness, in which case, the operator should exercise special care, not to do or say anything, which may tend to scare the patient, and it is wise, in such cases, to explain carefully everything that is going to be done,—for a child's fears are almost always fears of the unknown. But of course, there are children who like chattering for chattering's sake, and these are not difficult to deal with, except that everything takes a little longer.

The Human Question Mark

This particular specimen of chatterer asks stupid questions with machine-gun-like rapidity, and in querulous tone.

Treatment :

(1) Exclusion from the room of parent or any relation who may possibly answer the questions.

(2) Complete deafness to all except the occasional sensible question. It is important not to become annoyed with the child's rudeness.

(3) Especial care to explain what is being done, for some of the questioning is due to genuine nervousness.

Prognosis :

Sometimes sheer nervousness, otherwise not very good. You can cure the bad manners, but this is usually a spoilt child. (*N.B.* I am referring to the more objectionable type. Intelligent questions from the " chattering type " of child are quite another matter).

The Smasher

Rix has given this name to a type of child we all know. This type includes the unco-operative and the antagonistic, both of whom always have a perfectly good excuse for each separate accident. Firm measures are necessary, and all types of appliance should be tried, before the case is abandoned, as it must be if there is no improvement.

But there is another kind of Smasher who is well-meaning, as will be seen when he appears repeatedly with the frayed remnants of his appliance, which he continues to wear, shedding bits as he goes along, but persevering doggedly with the remains, which he balances in his mouth by some miracle of dexterity. It is puzzling to know what to do about these well-intentioned smashers, because, of course, the case suffers repeated setbacks, and fixed appliances are often worse than removable. We do not even know the cause, unless it is toffee, or cracking nuts. How do children manage to break 0.8 mm. steel labial bows ? It beats me ! The annoying thing about smashers is that the parent

is always inclined to be reproachful towards us as if it is the fault of our appliance every time. Beyond reasonable limits parents must be made to pay for the damage there is no alternative remedy.

The Wailing Type

This is one of the spoiled children which is recognisable by its oft-repeated cry, " But Mummy, I don't li-i-i-ike it ! " You have met it I'm sure. Sometimes, with tact and infinite patience you can achieve results, so long as the parent is not allowed in the surgery, but often it is wiser to postpone treatment until a later and more sensible age. In the case of a spoiled child I am firmly convinced that the treatment should be expensive—only so will you get co-operation. And when I say expensive, I mean just as much as that particular parent can afford, be it ever so little. If expense is no object then the outlook is grim.

And while I am on the subject I would say to the Ministry of Health that on no account should orthodontic treatment be free. That which costs nothing is valued at exactly nothing. If a poor parent pays only a penny or twopence a visit towards the cost of treatment, then the appliances have some value, and are respected accordingly. But in a disappointingly large number of cases " no expense " means " no co-operation."

In practice I have found that my best cases are often those to whom I have reduced my fee, and yet to whom the treatment is still a financial burden. It is human nature not to waste that which we can ill afford.

Reverting to spoiled children. Since the days of physical cruelty are happily over, the two worst crimes against children in my opinion, are injustice and spoiling. The former scars the child's mind, for children have an ingrained sense of fair play, and have not yet adopted a philosophy which can protect their acute sensitiveness to even slight injustices.

The worst degree of spoiling is a form of parental self-indulgence that I find it hard to forgive. It is a product of the small family, but is happily on the decrease in these days, when middle class mothers have as much to do as those of the working classes, and no time for spoiling. With few exceptions any normal child which is reasonably well brought up is attractive. Spoiling makes it hateful to itself, unpopular with its contemporaries and disliked by grown-ups. And the tragedy is, that it is not the child's fault.

The Negative Type

This is the child with the post-normal mandible and the post-normal soul. The complete example of this type of individual is untreatable, for it could not muster enough determination to say, " Boo." But do not despair. Some of them can be inspired to give a measure of practical help. Cases of this kind are instructive, in that they illustrate, and emphasise, the very cogent fact, that without positive help from the patient, we can anticipate at best, slow progress, and at worst, no result at all. Of course, fixed appliances have a special advantage in these " negative " cases, but even so it is always an uphill fight.

The Old Fashioned Type

Often the child of older parents, this infant with grown-up ways is not precocious, it is only lacking the society of other children. It is a little pathetic, very attractive and extremely amusing, as, for instance, when it makes conversation, about the weather and so on, to put *us* at *our* ease. It is polite, well-behaved and obedient, and from our point of view an excellent patient. It carries out instructions with sedate gravity—which makes us want to weep. It is quite a different person from the *precocious* type, which we see mainly in the films.

The Scamp

The plain honest-to-goodness naughty boy is one of the most attractive of our young patients. He has a wicked twinkle in his eye, and an irresistible smile, and he gets away with murder. There is nothing vicious about him, he is always cheerful, and he bears no ill-will to any man. As he travels through life he finds everything goes his way, and people fall for him like ninepins. As a patient you like him whatever he does, and he may be very good or very bad. He will be disobedient while it seems clever, but he usually gets bored with this, and then he'll

show you what he can do in the other direction. If you engage in a tussle with him he'll win, because you cannot be there all the time. If you are merely bored with his naughtiness he'll eventually give it up. A sensible parent will have his measure, in which case you will have no worries. There is no animosity and no sulks, for he can " meet with triumph and disaster and treat those two imposters just the same " — provided it is somebody else's disaster. I like scamps.

Abnormal and Subnormal Children

Treatment of abnormal or subnormal children is another problem, but one with which the real " children's man " is quite capable of dealing. Actually they excite our sympathy, even more than normal children, but their prognosis in orthodontics must be poor. With the abnormals one must be prepared for unexpected reactions, and treatment with appliances may be unwise. With the subnormals one must remember the mental age, when dealing with the individual. In both it is even more essential to gain the trust and friendship of the patient. This particular branch of child study might well occupy a whole paper.

Age Problem

We are prepared to consider the difference in character of our small patients one from the other. We must not overlook the changes in one individual which take place during the formative years. The developing child is a fascinating study, about whom one who is a parent could go on talking for hours, but it must suffice here to take note of some of the more important changes which concern us and our work.

Very young children, (4 or 5 years old) are usually friendly little souls who are prepared to do anything for you, if you get on the right side of them, but without particularly understanding why. To them, however, " out of sight " means " out of mind," and, with all the goodwill in the world, they are not very amenable to continuous effort. I sometimes think that if we could see our very young patients much more often—say every three days—we should, by continual reminder, achieve more success and suffer less disappointment, than we do. But perhaps we expect too much from a very small person, who is too young to be reasoned with, and it is often politic to wait two or three years, rather than risk prejudice to our subsequent effort.

For the next few years, say from seven to eleven, you have, in the average normal youngster, an amenable, uninhibited person, who is prepared to be co-operative, but who is still unimpressed by arguments concerning good looks, unless the existing condition invites ridicule. From our point of view those are good years on the whole, but with a changing dentition one must avoid boring the patient with too protracted a period of treatment. Rest periods can be of great help, but even so one must be careful, because for some individuals it is humanly difficult to start again. Some, on the other hand, are disappointed to have to stop.

Somewhere between eleven and fourteen one strikes a difficult period, during which the child needs careful and tactful handling—girls, possibly more than boys. Any parent will remember the *awkward* age through which his children have passed, and during which they may have become almost unbearable to those around them. The victims may suffer intense unhappiness during that time, and indeed their emotions generally are intensified. Unfortunately there is little one can do, except treat them with sympathy and understanding. I must confess that, for one reason or another, this phase does not always adversely affect our work. (It may depend upon whether we first meet the child at that particular time). One reason is a dawning interest in personal appearance, which is important. Another is our own detachment from the family. When you are out of sorts, it is the people you love best with whom you are at variance. They know you too well, and they take you too much for granted. They are, of course, impatient of emotionalism, and you feel that you are not *understood*. At such times, you get on better with strangers, or better still, with friends outside the family who show some understanding, such as a doctor or dentist you have always liked. We dentists find ourselves in a position to be very helpful in making life

more smooth for our little friends at this time, not by active interference (that would be fatal) but in a more negative way, simply by understanding. How many times have parents said " Will *you* talk to Johnny—he thinks a lot of what you say"?

After this time and during the 'teens the emotional period may continue, and one must remember that at this age, when the individual is neither child nor adult, it is acutely sensitive, and pathetically vulnerable. Sometimes this takes the form of increased shyness, which is most attractive, but is a curse to the subject, and boys tend to develop a dignity which is very easily hurt. One must remember this.

During these growing years, a youngster's capacity for suffering and unhappiness is equalled only by his capacity for enjoyment, which makes the this brightest, and, at the same time, the most pathetic period of our lives. When there is *real* trouble in a family, the effect on a growing youngster can be quite shattering, for the trouble is magnified out of all proportion, there being nothing in his experience by which to guage and measure its importance. A frequent cause of unhappiness is divorce of the parents. I suppose we all have such cases in our practices. In the main the best thing to do is to mind our own business, treating the situation quite normally and naturally, and never drawing attention to the fact that it is a situation at all. But sometimes, as an outsider, one can be helpful, by putting a point of view which would never be accepted from the parents themselves. For the young are puritanically moral in the standards they set for their elders.

There comes a time when the " 'teen age " girl begins to spread her wings and gently test them. You may notice the appearance of a tentative suggestion of make-up, and the beginning of a predatory gleam in the eye. You may be shocked one day to surprise a look, which, in an older girl, might be described as " making eyes at you." You can hardly believe it, having known her since she was " so high." But don't let yourself feel even mildly flattered—she is only trying it on the dog. Bless her heart, she has to start somewhere.

A girl develops more rapidly than a boy, and in her 'teens is in intelligence, composure, and those other attributes of the adult, quite one or two years ahead of a boy of the same age. Boys catch up later you will be relieved to hear.

Conclusion

Children are grand patients, and they deserve all our care and gentle handling. They are friendly happy, people and they cannot help affecting the lives of those who work amongst them. ' If children and dogs like him he can't be *all* bad."

Is there anything to equal the satisfaction of an orthodontic case that is going well? You have the pleasure of the artist, the pride of the scientist, and the deeper satisfaction of having contributed to the happiness and well-being of a young person—and you have made a friend. It is a high rate of pay for your trouble. Of course, on the other side, you have a lot of anxiety, and many disappointments, but they cancel out.

I would ask my colleagues to glance through their failures—their very few failures—of the past, and make a mental note of the proportion of those cases that have failed in co-operation ; and their successes, remembering in how many of those cases they have had the generous help of a perfectly grand little patient. Then let them consider whether it is worth while to study children as individuals, and not only as orthodontic cases.

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DISCUSSION

Professor H. H. Stones, in proposing a vote of thanks to the President for his Address, said that he had found it very interesting and instructive. It made him realise that it would be advantageous in the teaching of orthodontics to include some instruction in pædiatrics, and in particular of the psychological problems that might be associated with habits and their discontinuation. As the present

curriculum for dental students is already fairly full, some orthodontists might consider that such instruction should be given as part of a post-graduate course.

He had thoroughly enjoyed Mr. Russell Marsh's paper and, on behalf of the Society, thanked him very much for it.

The President thanked Prof. Stones for his remarks and the members for the way in which they had received the motion.

The meeting then terminated.

* * * * *

SERIAL MODELS OF A CASE TREATED BY THE EXTRACTION OF THE FOUR FIRST PERMANENT MOLARS

By K. E. PRINGLE, L.D.S.

THIS QUITE ORDINARY case is presented simply as material. From my point of view it is an experiment. When Mr. A. A. Wilkinson spoke here in 1942 he advocated, when we omit his exceptions, the extraction at 8 or 9 years of age of all four first permanent molars as a treatment of cases of normal arch relationship which had all the permanent teeth present and all the deciduous molars in position. He advocated this for the relief of crowding and for the prevention of caries. Many interesting points were made in the discussion but I think it is correct to say that no one present actually discussed the paper quite fairly as no one had any material exactly comparable with that of the speaker. One should draw no conclusions from one case but even one series may be of interest. $\frac{6|6}{6|6}$ were extracted at 8 yrs, 3 months.

The models are at **8.2., 12.3.**

I hope that extraction of $\underline{|D}$ at 6 yrs, does not invalidate the evidence.

Note: Confirming Mr. Wilkinson's statements:

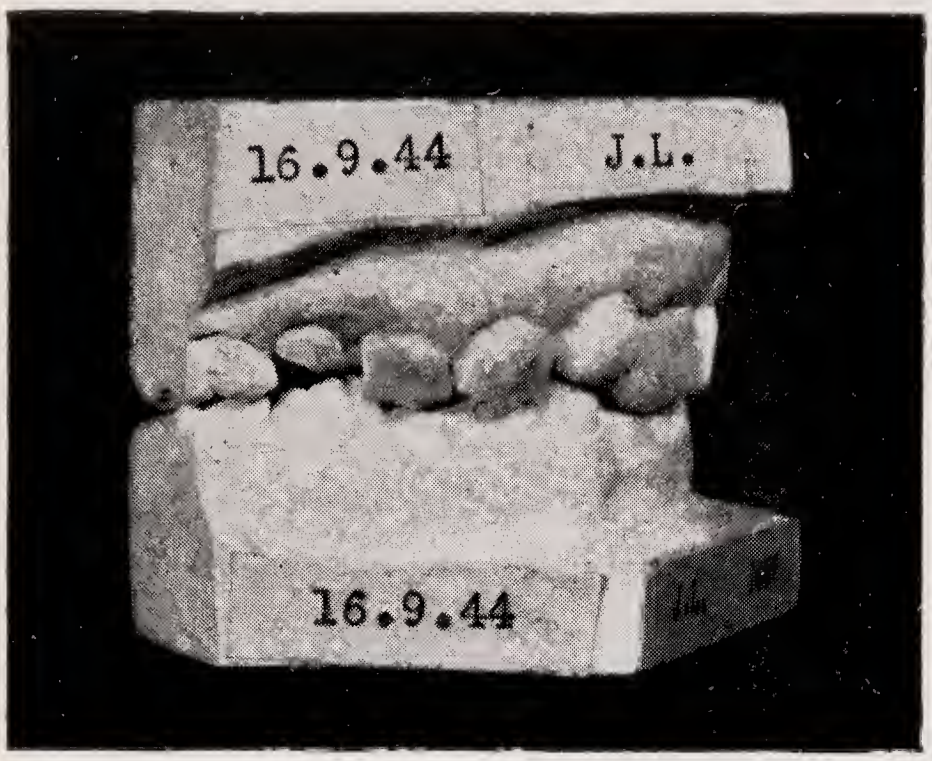
1. The incisor flap has not suffered.
2. Incisor alignment has improved.
3. With extraction of $\frac{6|6}{6|6}$ which were to some extent carious, no fillings were required in permanent teeth until the age of 11yrs, 11 mths, but it will be noticed that:
   - i. Caries is occurring, though possibly less than it might have been. At 12 yrs, 5 mths, she has had five fillings in permanent teeth, 2 occlusal cavities in each of the upper second molars and one occlusal cavity in the lower left first premolar. Many fillings in deciduous teeth were required.
   - ii. $\underline{5|5}$ are to be found erupting distal to normal.
   - iii. $\overline{5|5}$ are rotated through 90°.
   - iv. $\underline{7|7}$ are in lingual-occlusion.

There seems no reason why conditions favouring interstitial cavities or pocketing between the lower second molars and the rotated second premolars, which is so common a feature where the first are extracted at say twelve, should not occur in this case. So far, they have not, but you will notice that the space between $\underline{7\,5|5\,7}$ is closing.

(Illustrations are by the Dental Photographic Department, Guy's Hospital. My thanks are due to Mr. Tulley, Registrar and Miss Coales, Secretary in the Children's Department).

REF. Wilkinson, A. A. The Early Extraction of the First Permanent Molars as the Best Method of Preserving the Dentiton as a Whole. *Transactions B.S.S.O.* 1942-43.

Owing to pressure of space, only a representative selection of illustrations can be given.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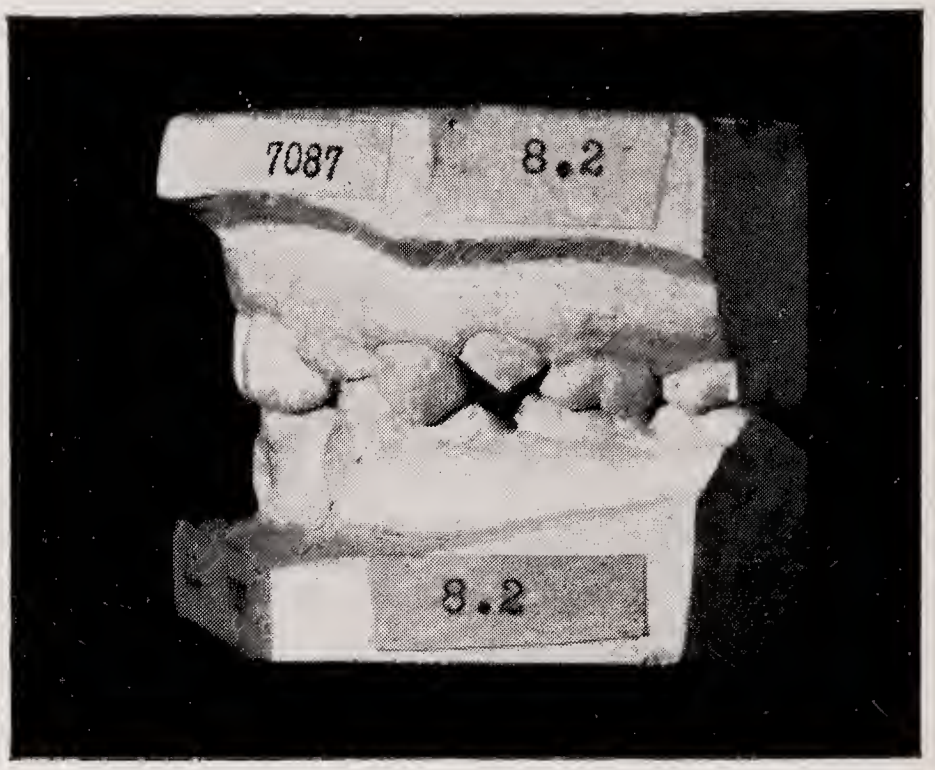
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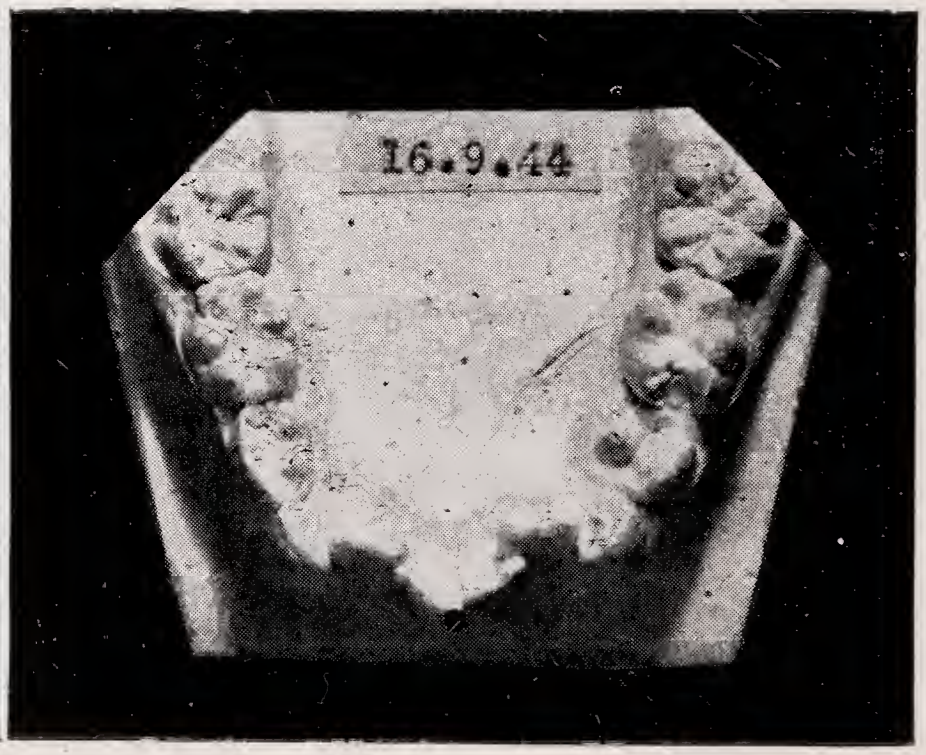
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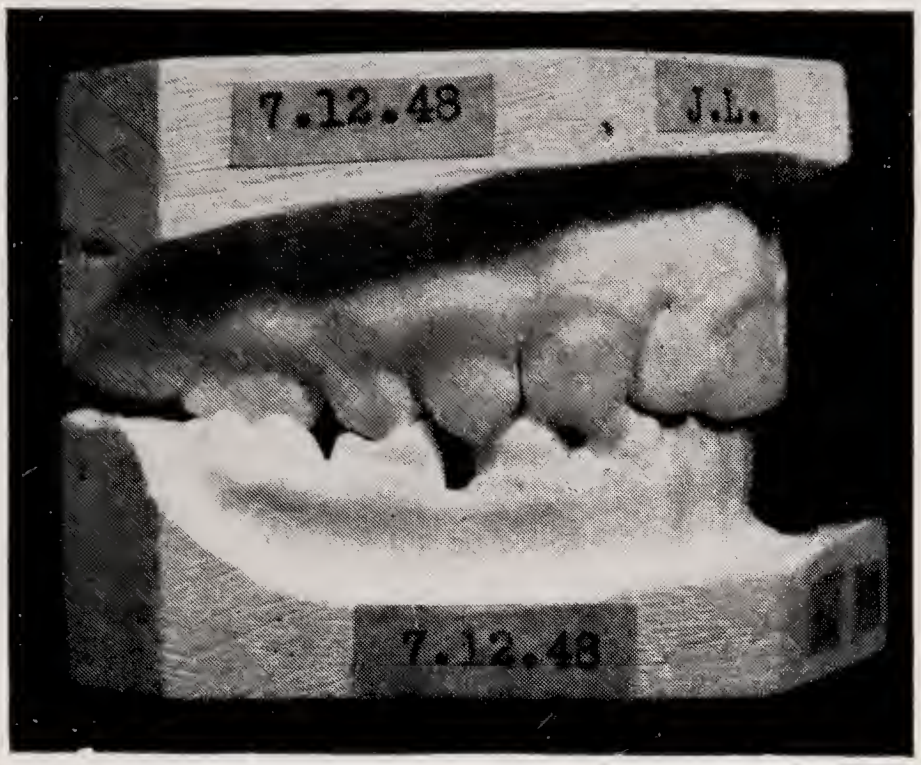
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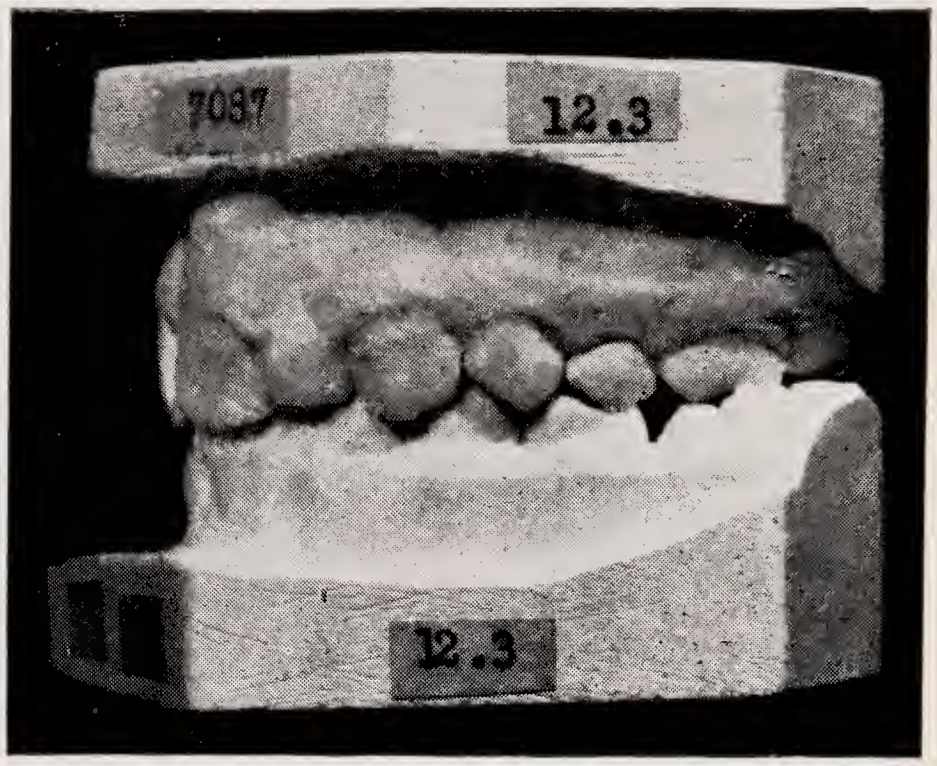
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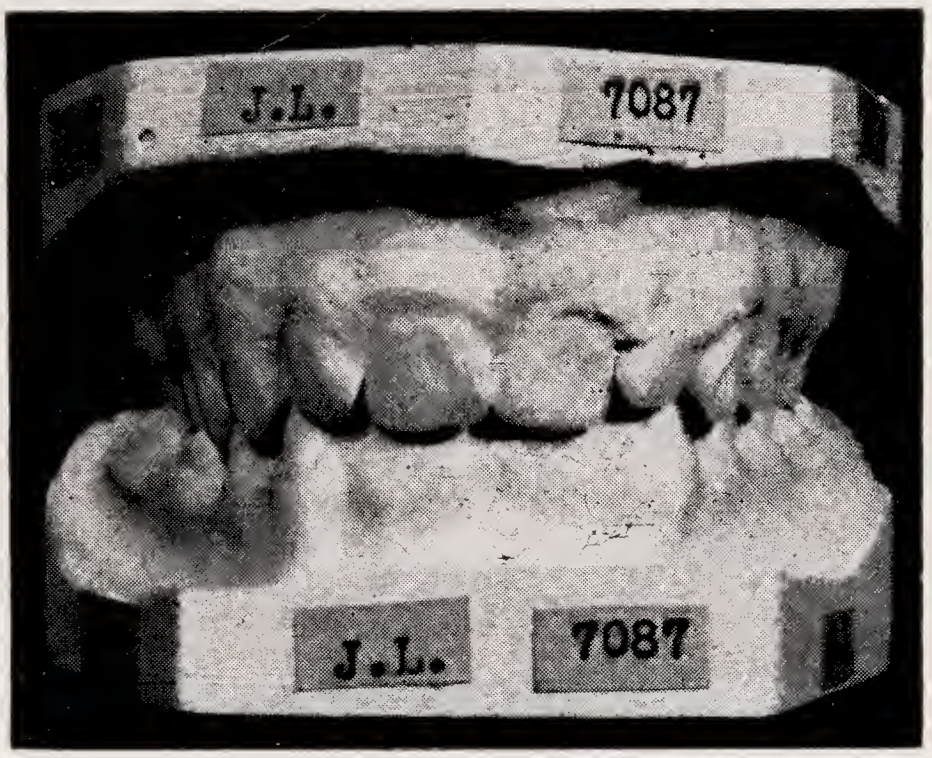
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DISCUSSION

The President said he would like to know whether, in the case shown by Mr. Pringle, the lower second premolars were of abnormal size as compared with the other teeth. That sometimes happened and it usually caused trouble when the full denture was present.

Mr. H. G. Watkin said he did not think that the extraction of the first permanent molar had anything to do with the rotation of the second premolar, as in the early radiographs the second premolar was shown to be rotating before it erupted. He thought it would have been a good thing to extract the first permanent molar a little earlier. There was not very much evidence of crowding in the first models.

He would like to ask Mr. Pringle whether he had enquired about the habits of the child, to find out whether she was accustomed to lean her head on her fist. Some children when they were studying leaned over their book with their fist against their cheek and so pushed the second premolars lingually.

Mr. H. Chapman thought the case shown by Mr. Pringle was a very interesting one. The members had seen how the second premolars fell back, so that there was a space between the first and second, yet in the present case that had occurred on one side only although the same treatment had been done on both sides. The case went further than any that he had seen before, in that the space was closing up again ; the premolar space on the right was actually getting less all the time. Mr. Pringle's communication was a most valuable one, showing a series of models extending over about six years.

Mr. K. E. Pringle, in replying to the discussion, said that he had not measured the lower second premolars, but he did not think that they were particularly large.

He thought there had been sufficient crowding to demand treatment of some kind. There were several different kinds of treatment which might have been tried, and he thought that he would try the extraction of the first permanent molars, although in the ordinary way he did not extract them. He had had the opportunity of examining a good many adults in an institution, and he had seen a good many results of first permanent molar extractions. Some results were good but he had seen far more which were bad.

He had not made any enquiries about the habits of the child, but he would do so next time he saw her.

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SOME OBSERVATIONS ON THE GROWTH OF THE ALVEOLUS IN MAN

By W. RUSSELL LOGAN, O.B.E., L.R.C.P. & S., H.D.D.

To the orthodontist the study of the growth and development of the alveolar bone cannot be other than of absorbing interest. It is not possible to say precisely where alveolus ends and where the supporting bone begins and there is apparently no structural difference between alveolar and basal bone, yet their origins and their ultimate morphology must be very different and the factors which influence the attainment of their structure are also manifestly diverse.

It is well known that the alveolus grows with the dentition and that with the loss of the dentition the alveolar bone atrophies and may become non-existent. It is much more significant that in cases of total anodontia the alveolus never forms and the bones have the appearance from the first of those of the senile jaws. Children showing this condition have a strange gnome-like appearance. The middle face is hollow and shrunken. It is to be noticed that there is little or no appearance of shortness of the vertical dimension while the jaws are at rest, but when the gums are approximated the sudden appearance of the nut-cracker like picture of old age is most striking. Whether the vertical dimension is as fully developed as in the tooth-bearing jaws or not I am not prepared to say, but this fact would appear to suggest that at least the development of most of the height of the bite is independent of the presence of alveolus or dentition.

I feel strongly myself that the vertical dimensions of the face are to a very large extent genetically determined, modified probably by other factors among which the growth of the dentition plays but a minor part. I would suggest for your consideration that the neglect, or at least the belated recognition, of this fact is in no small part reponsible for many of our failures in orthodontic therapy.

How then does the alveolus grow ? Let us consider the vertical direction first. As the tooth germs grow bony tissue is laid down around them and over them enclosing them in the crypt. With the onset of calcification the tooth grows in length as the calcified portion moves towards the oral mucosa, which retreats before it, carried on layers of new bone laid down by the perisoteum. There comes a time when the rate of movement of the calcified crown becomes greater than that of the alveolar increase. The external epithelium of the tooth germ meets the epithelium of the oral mucosa, fuses with it and the growth and movement of the tooth continuing, it erupts into the mouth. As it erupts the bone continues to be laid down on the crest of the alveolus.

We are, I am convinced, too apt to consider the eruption of the tooth as a period in its development, signifying the end of one process and the commencement of another. This is not so. The same process continues and eruption is not only an incident in the movement of the tooth and of the growth of its alveolar bone. The tooth continues to travel as the root is completed and bone continues to be laid down on the edge of the alveolus.

We may here pose the question ; does the eruption of the tooth ever stop, and if so when, and what stops it ?

Here the great difficulty arises. For the observation of movement we must have a fixed point from which to make our observations. The whole skull and face is growing and changing in every direction and many have been the attempts to find a plane of point of sufficient stability as to serve for a datum from which to make observation of growth movements.

There is a condition to which I would like to draw your attention which may be of some service to us in this connection.

The so-called retained or submerged temporary molar has held a place in recorded observation since the middle of the nineteenth century. In this not very uncommon condition, with which I am sure you are all very familiar, one or more

Fig. 1. *Lower cheek tooth region of girl* aet 16 *years showing phantom sockets after loss of deciduous molars.*

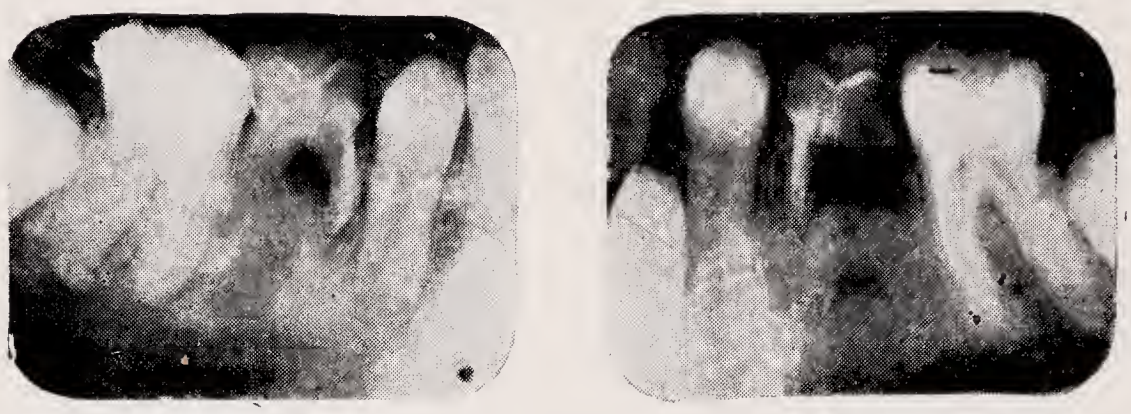

Fig. 2 *Lower cheek tooth region of boy* aet 13 *years showing phantom sockets with persistence of deciduous molars.*

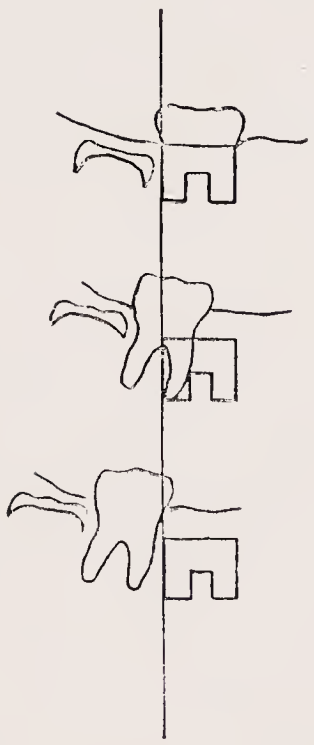

Fig. 3. (a) *relationship of second deciduous to first permanent molar about age three years.*
(b) *relationship at puberty if permanent molar moved forward. The anterior root of the permanent molar would have to encroach on the posterior root of the phantom.*
(c) *relationship at puberty if permanent molar does not move forward through bone but only tips forward slightly.*

Fig. 4. *Upper cheek tooth region of boy* aet 13 *years showing obliteration of phantom socket of milk molar due to downward and forward extension of antral cavity.*

of the deciduous molars is found to be lying below the occlusal plane. In the most extreme form of the condition the molar is completely enveloped in the alveolar bone, giving rise to the supposition that the tooth may never have erupted. Various terms have been used to describe the condition, varying according to the diverse views as to the etiology of the misplacement of the tooth. Such terms as inclusion, retention, ingression, enclavement, impaction, persistance, shortening, have been used in the description of what is essentially an identical clinical entity.

Izard and Dorian in their exhaustive monograph on the subject published in 1929 defined a retained tooth as one whose crown is partially or entirely contained within the jaw at a time when it should have taken place in the dental arch. How then does the tooth get into this strange position ? It might have failed to erupt. That on the face of it appeared to be the most reasonable explanation. But Edgelow as long ago as 1887 described just such a tooth contained in a swelling in the upper jaw which carried a cavity which had been filled with amalgam. The tooth had obviously been at one time in the oral cavity.

Villain also in 1925 published the record of a deciduous second molar so completely sunk in the tissues that the first premolar was in contact with the first permanent molar over it. Moreover the submerged deciduous tooth held an amalgam filling which had been placed in 1906, nine years previously.

Furthermore cases were noted where these teeth showed indubitable signs of occlusal wear showing that at one time the teeth had been functional.

What then had happended ? How had the teeth which at one time had been on the occlusal plane come to lie so far below it. Izard and Dorian believed that the teeth had retreated into the tissues. The force compelling the movement they believed came from their neighbours of the permanent dentition which, impelled by the force of the bite, approximated to each other and pressed the intervening deciduous tooth downwards into the tissues whence it had originally come.

The true explanation is further to seek.

Oppenheim working on primate histological material demonstrated that both alveolar bone and deciduous tooth are absorbed to a larger extent than the actual movement of the permanent successor requires and that a new formation of both bone and cementum could take place during quiescent periods. During such a period it is possible for a solid junction between the bone and the dental tissues of the deciduous tooth to occur. Kronfeld in his textbook gives a fine illustration of an extensive bony union between a lower deciduous second molar and the alveolar bone.

Here we have, I am convinced, the true explanation of the retained deciduous molar. At some time during the absorbtion of the root an anchylosis is made with the alveolar bone, any movement of the tooth relative to the bone is made impossible and we are presented with a fixation which persists unaltered.

Now while this is a notable contribution to the histo-pathology of the jaws it is also a milestone in the study of the development of the dental arches, as at last we have found what has so long eluded us—a fixed point from which we can make measurements of growth and development.

There can be no doubt then that if a milk molar becomes anchylosed then any disparity in height between its occlusal surface and the occlusal plane can only be due to increase in the height of the alveolus and the eruption of its neighbours. If its deciduous neighbours have risen they can only have done so by bone deposition in the depths of their sockets and on the upper margin of the alveolar process. Thus we have direct evidence of the deposition of new bone in the depths of the sockets of the teeth as well as on the edge of the alveolar crest in man, analogous to the vertical growth of the alveolus demonstrated by Brash in the pig, using the method of madder feeding.

The question now arises as to whether we can get any information as to horizontal growth by the study of such cases.

Friel has presented the thesis that all teeth move towards the front of the mouth in man. Scott in his recent communication to this Society also stated his belief that, " It cannot be said that the erupting

permanent teeth are thrust forward from any fixed basis ; they are, in fact, drawn forwards by a dense cord of fibrous tissue . . . which is continuous in front with the oral mucous membrane."

There came into my hands through the courtesy of a colleague the radiographs of a brother and sister of thirteen and sixteen years of age respectively. The children were to all appearance perfectly healthy and well developed. It was noted however that several of the deciduous molars were still persisting when they should have been shed, and on that account the cases were submitted to radiological examination. The films of the girl's cheek teeth region show in the first place that the permanent first molars have been extracted some time previously and that gaps occur in the dentition, on the right side from the canine to the second molar with a retained first milk molar in contact with the canine, and on the left side from an erupted first premolar to the second permanent molar. (*Fig.* 1).

If the intervening bone shadow is carefully inspected a variation in the trabecular pattern is evident, the phantom as it were of the sockets of the second deciduous molars. The roots have apparently been absorbed and bony tissue laid down in their place but the subsequent remodelling of the bone structure and its integration with the trabecular system of the surrounding bone has not taken place. It is also to be noted that a similar process has occurred at the roots of the right first milk molar where finally a fusion of dental tissue and alveolar bone has given rise to a typical retained milk molar, the occlusal surface of which is level with the cingulum of the, by now, fully erupted permanent canine.

What the nature of this abnormal process may be I cannot say. I can only give thanks that the appearance was not destroyed by the subsequent eruption of a premolar through the tissues in which its effects are visible.

On careful examination one can perceive the entire outline of the sockets of both roots. The appearance is limited above by what would appear to be the lip of the previous alveolar socket and it is to be noted that this now lies some five millimetres below the present alveolar edge.

Now the point which I wish to put is this, that here we have a fixed point, fixed in space and in time also, if we can evaluate it correctly.

It cannot have been formed earlier than about the age of three and a half years for that is when the apex of the tooth in question is fully formed. The other limit is more difficult to determine but is unlikely to be later than the age of five years as absorbtion of the apices and filling in of the socket then start. I would draw your attention also to the fact that the apex of the phantom socket is on a level with the apices of the neighbouring teeth. From that I would deduce that the earlier limit is the most likely as it would seem that the socket has not risen appreciably from the position of its first formation. . .

I therefore present my phantom socket as a fixed point in the alveolar bone and fixed about the age of three and a half years.

From this point as datum can be demonstrated the growth of the alveolus in height as being in the region of five millimetres. It is also demonstrated that the roots of the permanent teeth do not grow downwards into the basal bone. The crown and the roots as they are formed move upwards in the growing alveolus.

When the films are examined for evidence of horizontal movement, there is little definite information to be had from this particular case apart from the unlikeliness of any forward movement amounting to anything like the breadth of a molar. The right first premolar is in front in contact with the canine and shows little if any movement forward from the phantom roots of the deciduous molar. The second molar shows characteristic tipping following the loss of the first molar but again, taking into consideration the position of the apex, no evidence of forward movement is to be seen.

I now show you radiographs of the brother of the last case at the age of thirteen years (*Fig.* 2). Again the second premolar germs are absent. The dental arch is, however, complete and there has been no anchylosis of the second deciduous molars the roots of which show little

or no signs of absorbtion. Once again we see that the bone structure of the sockets has failed to become homogeneous with that of the alveolar bone.

The vertical growth of the alveolus is again amply demonstrated in this case by the increase in height between the upper surface of the original socket and the under surface of the present roots. This amounts again to at least five millimetres.

As to forward movement, however, I would submit that there is no evidence whatever. If the dentition had moved forward since the formation of the phantom about the age of three and a half years then the deciduous molar would lie not directly above the phantom but obliquely above and before it. In addition any forward movement of the permanent first molar would of necessity bring its roots into the area of the phantom socket and, as it were, eclipse it to some extent. Of this there is no sign whatever. (*Fig.* 3).

Finally there remains the possiblity, again demonstrated by Brash in the pig by the madder feeding method that each tooth might move forward by the process of bony absorbtion of the anterior part of the tooth socket and deposition on the surface of the posterior part. One would expect the phantom to share in this process and if it did so the anterior-posterior breadth of the phantom socket would be diminished by the amount of forward movement.

Again there is no evidence of this in the films, within of course the limits of possible observation which I would assess in the region of one millimetre.

You will have noticed that the previous observations are confined to the lower jaw. Let me show now the same state in the maxillary arch. (*Fig.* 4). Once again the anchylosed second deciduous molar is seen with no permanent successor. The permanent dentition has erupted well beyond the occlusal surface of the milk tooth. There is, however, no phantom, the area of bone has been absorbed by the descent of the floor of the antrum. We are denied the use of this method of observation in the upper jaw.

The conclusion which I draw from the study of these two cases are the following. In two children whose dento-alveolar development, apart from the absence of certain teeth of the second dentition, could be considered well within normal limits, there is demonstrated a vertical growth of the alveolar process in both upper and lower lateral segments of the region of five millimetres between the age of about three years and puberty. During that time there was no evidence of any forward movement of the lower molars, apart possibly for a certain tipping to take up the extra space afforded by the succession of the narrower second premolar to the broad second deciduous molar. No evidence is available by this method regarding antero-posterior growth in the upper jaw.

While it is impossible to generalise from two cases I feel that the thesis that the lower teeth move forward through the alveolar bone during their development in man will require the production of very strong and direct evidence indeed if it is to receive universal acceptance as normal human dento-alveolar development.

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DISCUSSION

The President said he was sure everyone present had listened with very great interest to Mr. Logan's remarkable example of observation and deduction. He wondered how many times such things as Mr. Logan had described had been shown in X-ray photographs but had not been observed.

He remembered a casual communication by Mr. Visick some two or three years ago, in which Mr. Visick did not emphasise what he himself thought was the most important point about the case described. It was a submerged or retained 6-year-old molar which remained approximately at gum level in the upper jaw on the left hand side when the other teeth were fully erupted. There was a vertical depth of 3 mm. between the crown of that tooth and the crown of the opposing molar, all the other teeth being in occlusion. The child, who was 11 $\frac{1}{2}$ years old, went away for eighteen months, and when she returned the vertical depth had increased from 3 mm. to 11 mm., which was a remarkable demonstration of growth during that period. In that case also there had been a fixed point.

Mr. J. W. Softley, said he thought there was one method by which a tooth could move forward in the lower jaw in relation to the body of the bone, namely, by an inclination of the tooth itself. If, instead of erupting absolutely vertically, a tooth happened to be tilted a little forward, the line of eruption would be upwards and forwards, so that as the alveolar height increased any fixed point on the crown of the tooth would take a position a little further forward in relation to any point on the base of the bone. He thought it was very likely that that was one of the things which people had in mind when they spoke of a forward movement of the teeth through the bone. The teeth did not actually move forward but they erupted upwards and forwards.

Miss K. C. Smyth also thanked Mr. Logan for his contribution on a very interesting subject.

In regard to the anchylosis of the deciduous molars, in many cases which she had followed up for a number of years there was apparently anchylosis for a long period and then the teeth suddenly became loose and were shed in the normal way.

The President had mentioned a case of Mr. Visick's in which a permanent tooth remained below the occlusal level after the other teeth had erupted, and she had a similar case which she would like to bring before the Society when an opportunity occurred. She had recently had X-ray photographs taken of it. The submerged tooth in this case was the lower first permanent molar on one side only. The third lower molars were present and they showed an equal tendency to impaction on both sides. The space between the submerged tooth and its antagonist in occlusion was quite definite but not very large, because the upper first permanent molar was dropping down below the occlusal level, apparently in an endeavour to maintain occlusion with its opposite number.

Mr. H. Chapman said he thought that Mr. Logan's explanation that teeth remained submerged owing to anchylosis was most interesting. At one time it had been thought by many people, including, he believed, Mr. Pritchard, that there was no anchylosis between deciduous teeth and the bone, but it appeared that that was not maintained now, and one frequently heard of the possibility or the probability that deciduous teeth were anchylosed. There seemed to be fairly good evidence in Mr. Logan's paper that that was the case.

In regard to medial movement, it was generally believed that in some cases lower molars, for example, moved forward when deciduous molars were lost, but there were other cases in which that did not happen, and that was why it was not necessary to put in a splint to keep a space immediately a deciduous molar was lost. Further examination of this problem was required, in order to see whether a case or cases could be found in which a molar had moved forward in the absence of the second premolar with disappearance

of the phantom roots. He thought, however, that the cases which Mr. Logan had shown were probably examples of those in which in any event the tooth would not move forward.

Mrs. Bernard Oliver asked whether Mr. Logan suggested that there was never forward movement in any jaw or only that there was not a forward movement in the case which he had shown. She did not think that the cause of the forward movement was known, and in the case in question there were probably no third molars which might cause it.

Mr. K. E. Pringle, referring to the question of anchylosis, said that if one had sections of teeth which were below the line of occlusion one sometimes saw absorption processes only, sometimes obvious anchylosis, and sometimes absorption and anchylosis going on at the same time. He could not help feeling that there was some sort of balance between these two processes.

In regard to the question of forward movement, could Mr. Logan say whether it was forward movement through the bone or with the bone ?

Mr. Norman Gray said that Mr. Logan had raised a very interesting point in connection with deciduous molars. The problem was one which was exceedingly common and one about which warning was needed, because often the cases appeared to be very simple but were really difficult. The case of a child of 12, 13 or 14 who had retained deciduous molars might prove to be a very complicated case indeed. At the moment he had a patient of $13\frac{1}{2}$ with retained baby molars. About two years ago this boy had an unerupted baby molar and unerupted premolars, and he thought the only thing to do was to remove the baby molar. He took about a dozen X-ray photographs of it and removed it, but the crowding was just the same. There was no sign of the loss of the remaining baby molars and the whole case was absolutely static.

It seemed to him that the problem involved was one of the basic problems of orthodontics, namely, the question of bone growth. It was wrapped up with open bite and uncrupted teeth, and it was one of those things which were sometimes a matter of mechanical obstruction and sometimes growth or lack of growth. It was a question of how to find the causes and how to deal with them.

He had another case which was most troublesome ; the child's teeth simply would not erupt. The child's father was an orthopaedic surgeon and had said to him : " I cannot make bone grow and I do not suppose that you can."

Some of the cases appeared to be due to anchylosis, some to exostosis and enostosis going on together, and some to sheer lack of bone growth ; there seemed to be some functional or glandular trouble. He thought that further study of uncrupted premolars and retained baby molars was needed, and if orthodontists pooled their knowledge something might be found which would one day resolve itself into a lack of bone growth.

Miss K. C. Smyth said she had found that, in some of the cases where there was a large space between deciduous molars for a long period of time, it was caused by the common tongue thrusting habit. The tongue was thrust out into the space at the side of the mouth and it became accustomed to resting there, and when the deciduous molars were lost it had the effect of keeping the premolars depressed and preventing them erupting.

Mr. H. G. Watkin agreed with Miss Smyth and said it could easily happen that the tongue was thrust between the upper and lower cheek teeth and prevented the premolars erupting. If a plate, with curtains on each side, to restrict the movement of the tongue, was inserted, it would be found in many cases that the teeth would erupt.

Mr. R. V. Tait asked Mr. Logan whether the ' phantom ' appearance might not be simply an area of sclerotic bone formed in response to chronic infection of the deciduous tooth. Where the deciduous tooth was visible in the radiographs shown, infection around the roots seemed to be present in each case.

If this interpretation is correct, the phantom would bear no exact relation to the earlier position of the tooth.

Capt. Allan asked whether Mr. Logan could explain a little more clearly how the phantom came to be formed. It was difficult to interpret X-ray photographs which one merely saw projected on the screen, but it seemed to him that the appearance of the X-ray photograph in question might be due to parodontal infection round the tooth producing a marked cirrhosis of the bone.

Mr. Norman Gray said he believed that a certain time elapsed between the extraction of a tooth and the complete obliteration of the tooth socket, but he was not sure how long that time was. That might have some connection with the appearance of the phantom.

Another member said he agreed that the formation of the phantom might well start at the age of $3\frac{1}{2}$ years, but, in view of the fact that there was no successor to bring about any resorption of the root, he did not think there was any justification for putting a ceiling of 5 years on the time for the formation of the phantom. He did not see any reason why the phantom should not form at 6, 7 or even 9 years of age.

Mr. Russell Logan, in replying to the discussion, said he agreed with Mr. Softley that there was a forward inclination of the teeth but he maintained that there was no evidence of a solid bodily forward movement of the teeth. The extra space between the very large E and the very small second premolars was undoubtedly taken up, and he thought that was due to the tipping forward of the molar, but he did not think the molar moved forward. It had been shown that the front of the face came forward nearly an inch between the age of 3 years and puberty. That could be explained by the laying down of bone under the periosteum in the front of the face, but how did the teeth come forward an inch ? They ended up by being an inch ahead. How did they do it ? Brash said that the pig's teeth moved forward ; they swam solidly through the bone. Brash, however, was careful to say that did not necessarily apply that to human material. He himself maintained that in the two cases which he had shown there was no evidence of the teeth swimming solidly through the bone to the front and that they did not come forward in that way. That was the point that he had attempted to make in his paper.

He agreed with Mr. Pringle that anchylosis and absorption could and did go on intermittently, one after the other, and in that connection he would draw attention to the immense amount of work done by the Vienna school a considerable time ago. A great deal of work had been done on the subject on the Continent, and as long ago as 1927 Oppenheim had pointed out that anchylosis and absorption could go on one after the other, and that view had been supported by Austrian, Russian and German orthodontists.

He considered that a very important aspect of bone growth was involved, and he hoped that orthodontists would watch for the phantoms in their radiographs and send him any cases which they found, as he would like to collect a large number of them. He thought that exceedingly valuable information about alveolar growth might be obtained from them. There must first be a phantom and, secondly, there must be no premolar underneath to obliterate it, so that the cases would not be very common.

He did not know how the formation of the phantom occurred. It was not the remains of the root. The radiographs did not show up very well on the screen, but they in fact showed that the alveolar socket was present and that bone had formed inside the socket but it had never been integrated.

As to the time when the absorption occurred, obviously the ordinary factor which induced the absorption of the roots of temporary molars did not obtain in the cases in question, so that the official time, so to speak, would not apply to them. They were abnormal to that extent.

He agreed that the phantom could have been formed at the age of 9 years, but the later the time ascribed to the formation of the phantom the more the vertical growth to be accounted for, and he had therefore put the age as early as he could. There was no definite information about it.

In regard to the possibility of chronic apical infection, he did not think there was any in the cases that he had shown, but he had no ideas about the pathology of such cases.

He wished to thank the members for the very kind way in which they had received his paper.

On the motion of the President, a vote of thanks was accorded to Mr. Russell Logan and Mr. Pringle, and the meeting then terminated.

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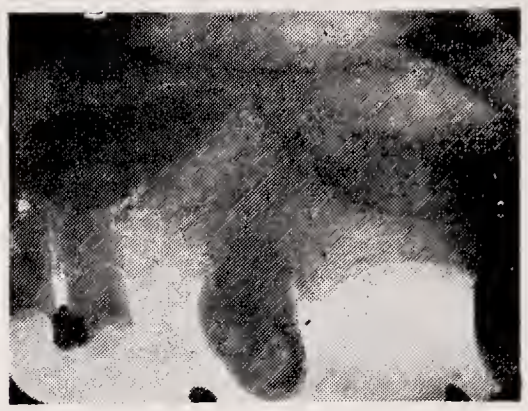
AN UNERUPTED CANINE IN A MAN AGED 70

By HAROLD CHAPMAN, F.D.S., R.C.S. (Eng).



The illustration shows a horizontal upper canine in a man age 54: he died 21 years later at age 75 (1947), the canine still *in situ*, never having caused any trouble. Mr. Chapman in replying to a discussion on the films said that they were given him by a colleague, and that the ages were correct within a year or two. He said that buried canines were frequently the cause of trouble, but here was a case where at the age of 75 the canine does not appear to have had any adverse effect on the adjoining teeth.

* * * * *

DISCUSSION

The President said that in his very early days in practice he had what might be considered a stroke of luck. A patient was sent to him suffering from tic douloureux, and it was really a tragic case. Every time one side of the patient's head was touched, she went into paroxysm for twenty minutes or so. The doctor thought that six lower teeth which were pyorrhoeal might be the cause, but being fairly fresh from his final examinations, the speaker noticed a swelling of the palate on the right side, and he ascertained the fact that the pain dated from the first time the patient wore a full upper denture. A buried canine was discovered which was the cause of all the trouble, and after it was removed the patient gradually recovered; the paroxyms became less frequent, and eventually the pain disappeared altogether.

When people were told that it was alright to keep a buried canine, he was of the opinion that a warning should be added to the effect that, in combination with a denture, it was liable to cause trouble.

Mr. Watkin expressed the view that it was very dangerous to leave a canine untouched. Some time back he had a twenty-five year old patient who had been troubled for fourteen years with a buried canine, but after it was taken out there was no further trouble. The patient had been taking sedatives for a long time to "make life worth living." She suffered from terrible headaches, so that it would appear that if no trouble were experienced with buried canines, it was purely a question of luck. In his opinion a great deal depended upon the position of the

tooth. If it were not touching any nerve or adjoining teeth, it might be alright, but it was rather like sitting on a volcano.

Mr. Breakspear asked Mr. Chapman whether in the cases mentioned he knew of any dentures having been worn.

Mr. Chapman, in reply, said he had no knowledge as to that.

Mr. Levien asked whether Mr. Chapman recommended that buried canines should be left *in situ*.

Mr. Chapman, in reply, pointed out that he stated that they need not always give trouble. There was evidence that they did give trouble, but he was showing that at the age of 75 it was possible to have a canine which did not give trouble although it was horizontal and buried.

Mr. Hardy asked whether Mr. Chapman had found any cases where a buried canine had given trouble by rolling on the root of the lateral, or some other cause.

Mr. Chapman replied that he had not. He recalled an occasion when a boy came to him who had two canines which were buried and inclined medially in the region of the centrals, and both centrals were almost entirely absorbed. To the best of his recollection the boy had no pain, nor were the teeth loose as one would have expected in view of the small amount of root which was left.

Mr. Watkin said if canines were brought down it would be possible to crown them like centrals. He had one case in which the canine was over the central. He took the tooth out, brought the canine out of position, and then put a crown on it.

The President said that in case his earlier remarks were a little misleading, he quite frequently advised the leaving of the buried canine alone so long as the parents and the child were warned that it was there, and if there were subsequent neuralgia, something ought to be done. It was a problem to decide whether to remove the canine, get it down into position—an operation which might involve the loss of one or more teeth—or advise leaving the tooth where it was after giving a warning. The three courses were open to orthodontics in different circumstances.

Mr. Chapman agreed that there were various courses open to orthodontists. If the tooth was left in, he invariably advised that an X-ray should be taken each year in order to see and detect any absorption of adjoining teeth.

A vote of thanks, proposed by the President, to Mr. Chapman for his short communication, was carried by acclamation.

* * * * *

DEMONSTRATION MEETING

CORRECTING THE RESULTS OF EARLY LOSS IN THE LOWER ARCH

By J. D. HOOPER, L.D.S. Eng.

The models of seven cases were shown in which the " collapse " of the lower arch as a result of early loss of deciduous teeth had been corrected.

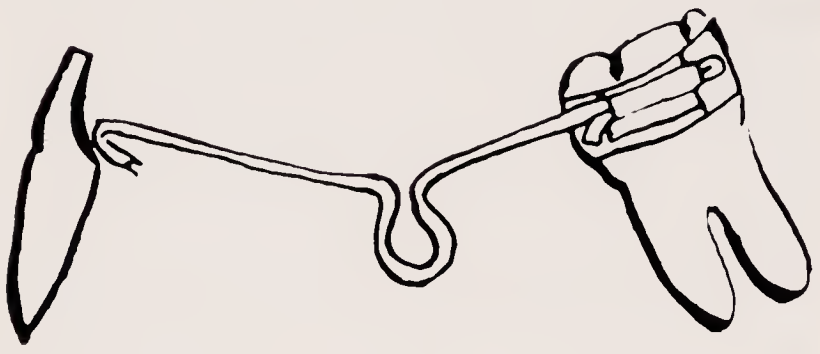


Fig. 1. 0.7 mm S.S. lingual arch with loops. Adjustment of the loops causes proclination of the incisors and tilts back the first molars.

Photographs by courtesy of the Royal Dental Hospital.

The appliances by means of which the treatment was carried out were demonstrated.

Attention was drawn to the remarks of J. W. Softley in his paper " Factors concerned with Close Bite " in which he stressed the importance of a complete lower arch and to Miss K. C. Smyth's support for this view in the discussion of the same paper.

Fig. 2. Models before and after treatment showing the appliance in position. In this case an auxiliary srping was fitted to move $\overline{4}$ mesially increasing the space for $\overline{5}$.

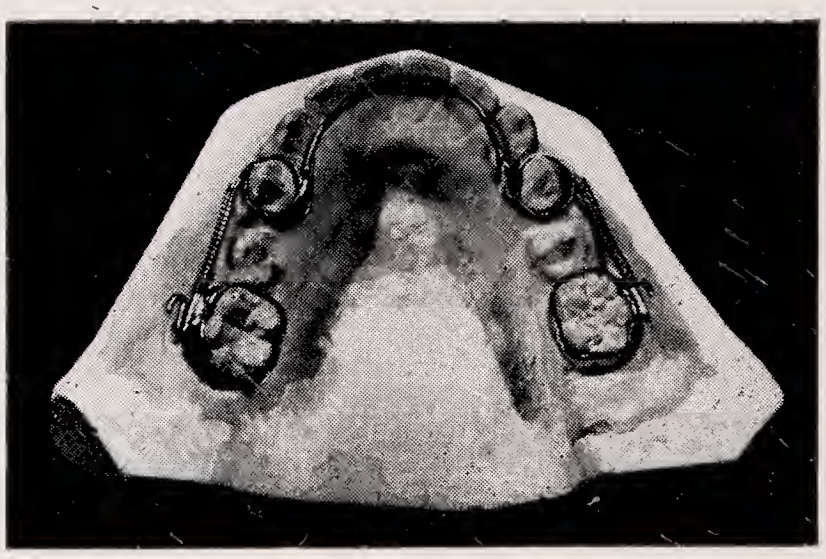


Fig. 3. Appliance used in conjunction with intermaxillary traction. With this appliance the anterior segment is moved forward by intermaxillary force while the molars are moved distally.

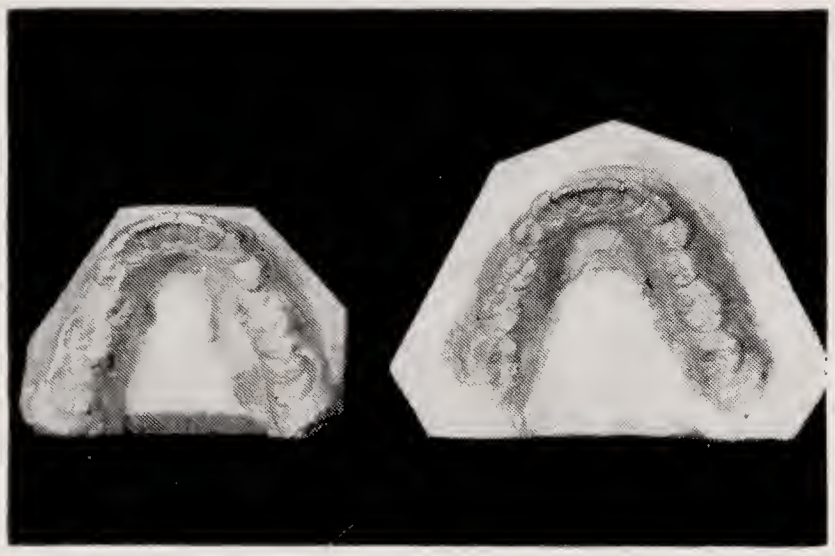


Fig. 4. Models before and after treatment with this appliance.

Fig. 5. Models of grossly collapsed lower arch, before and after treatment and showing the appliance used. In this case third molars germ were removed and the second molars moved distally. First molars were then banded and moved back. Second premolars moved spontaneously into the arch.

* * * * *

THREE DEMONSTRATIONS

By M. A. KETTLE, L.D.S. R.C.S.

1. A MODIFICATION OF THE LOWRIE PORTER APPLIANCE IN STAINLESS STEEL

The appliance takes the form of a side hook made from 1 mm. S.S. wire and attached to the first upper molar and upper first premolar only. It fits into a Selmer Olsen free sliding tube on the buccal surface of the molar band. *Fig.* 1. A stop is welded on to the side hook and a piece of 0.3 mm. S.S. wire is wound round it to provide positive distal pressure against the buccal tube of the first piece of corrugated S.S.

The premolar attachment is provided by welding a piece of corrugated S.S. tape 3 mm x 0.2 mm. A horizontal cut is made through the corrugations so that the side hook can be ligated with soft S.S. 0.25 mm wire into this channel. *Fig.* 2.

To the anterior end of the appliance a hook is attached for intermaxillary elastics. The hook is lowered to the occlusal surface of the premolars to bring the intermaxillary traction as nearly parallel to the line of occlusion as possible. *Fig.* 3.

The lower appliance consists of a lingual bow fitted near the gingival margin of the

Fig. 1

anterior teeth and attached lingually to bands on the first lower molars. A hook for the intermaxillary elastics is welded on to the buccal surface. *Fig.* 4.

The appliance is used for those cases in which there has been an apparent mesial or forward drift of the upper buccal segments and in which a distal movement of the buccal segments is indicated.

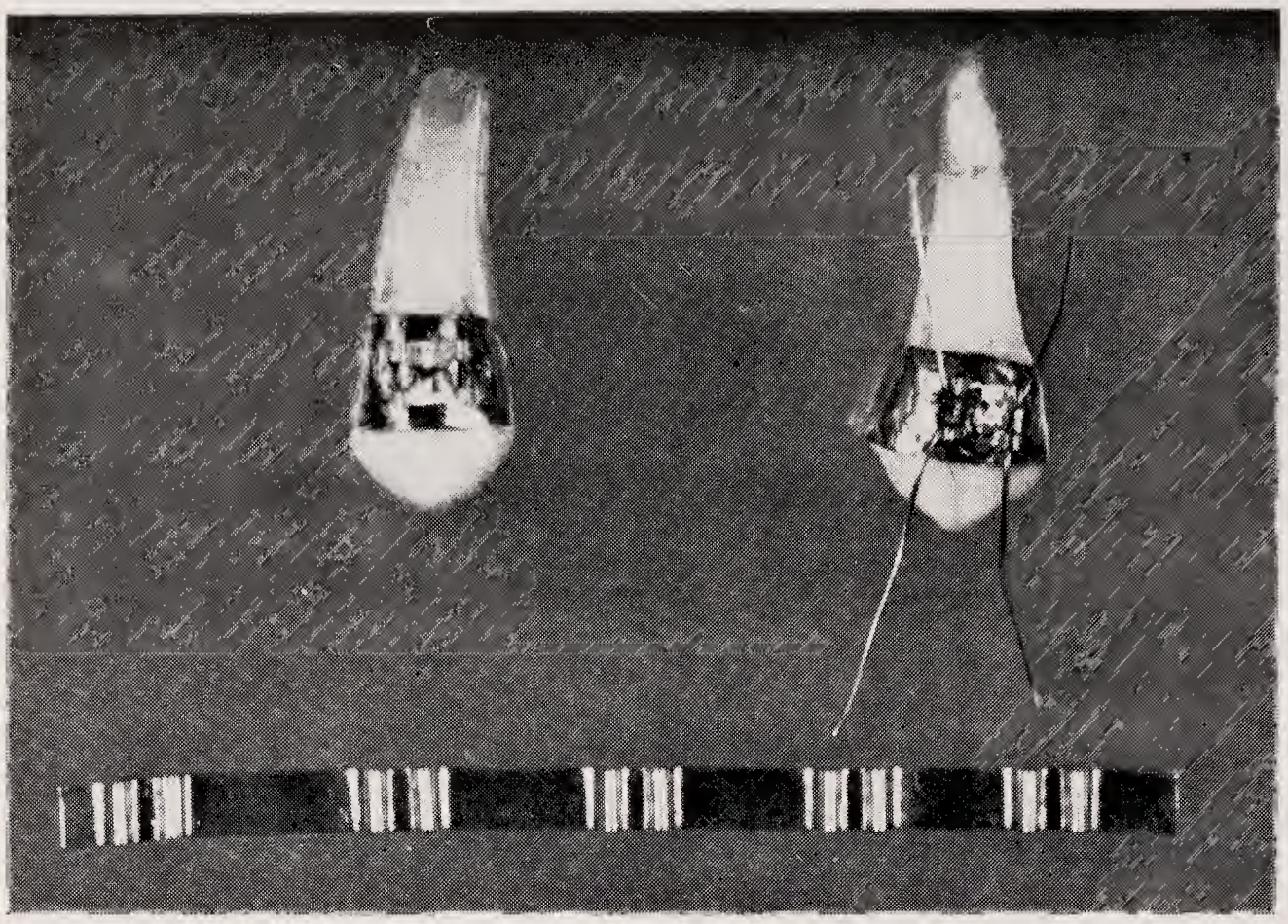


Fig. 2

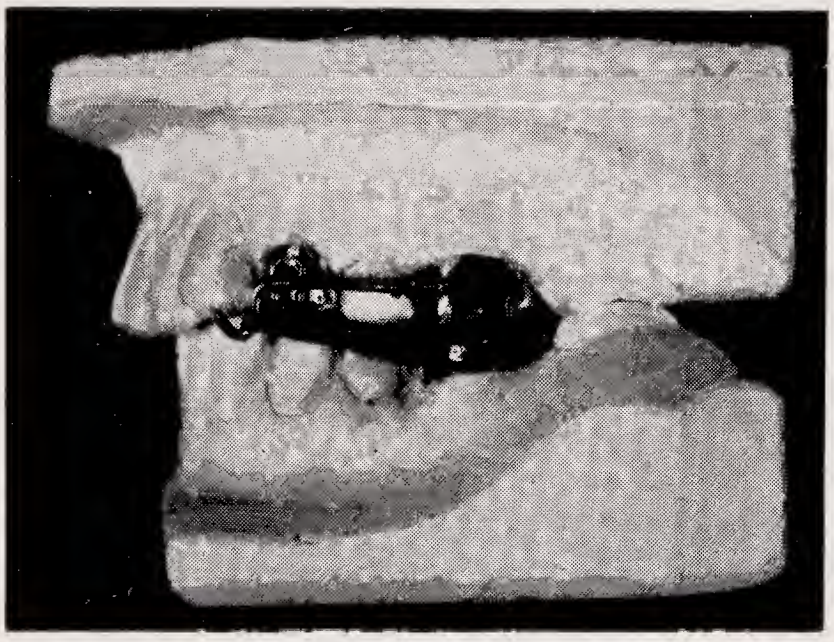


Fig. 3

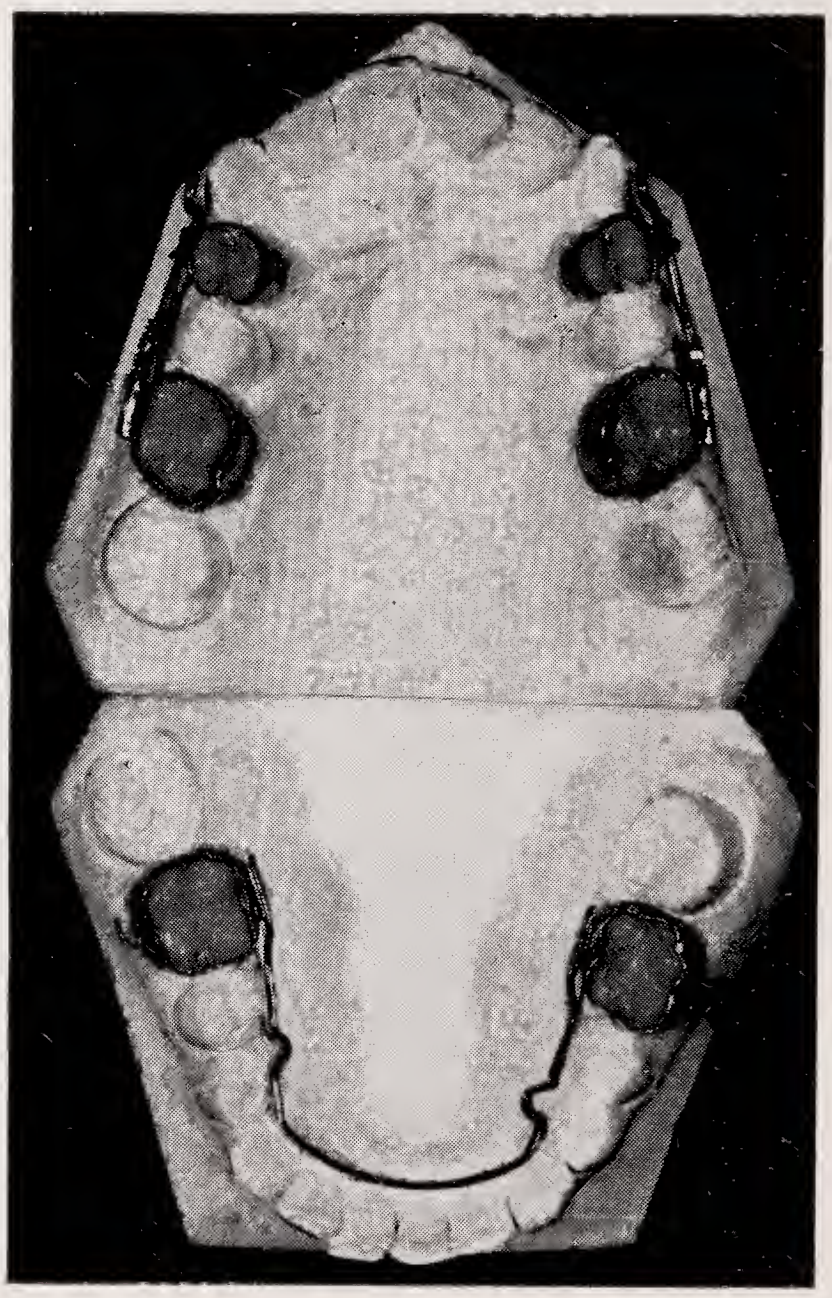


Fig. 4

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The International Journal of Orthodontics and Dentistry for Children. Vol. XIX No. 3 Page 242. March, 1933.

Lowrie J. Porter. Conservatism in Orthodontic Procedures and Appliances.

American Journal of Orthodontics and Oral Surgery. Vol. 33, No. 3, Page 109-140, March 1947.

2. AN APPLIANCE TO BRING BURIED TEETH INTO ALIGNMENT

Fig. 5

Fig. 6

The appliance consists of a high labial bow in 0.9 mm S.S. wire attached to anchor bands on the first upper molars. *Fig.* 5., or constructed into a removaeble appliance.

In the region of the buried tooth a goal post is bent in the high labial bow to accommodate a fine wire spring made from 0.25 mm S.S. wire. A number of coils are put into the spring to give a gentle prolonged thrust over a long distance. *Fig.* 6.

A pin is cemented into the buried tooth and the fine wire is attached to it. The middle coil is made slightly larger to facilitate its movement on and off the hook.

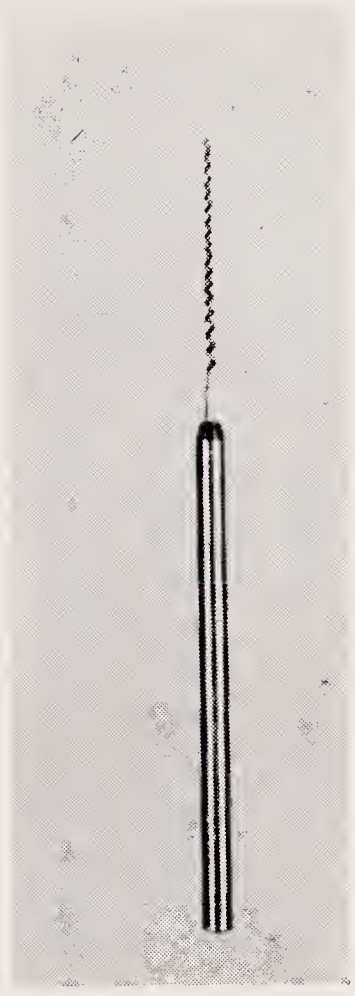

Fig. 7

Under a local or prolonged general anaesthesia, a flap is laid back and sufficient bone removed to expose the crown of the buried tooth. It is most convenient to make the pin hole in the incisal edge of the tooth at the mesial or distal end. A hole is drilled with No. $\frac{1}{2}$ round bur through the enamel and down the amelodentinal junction. Into this hole a piece of 0.5 mm irridio platinum wire is fitted, allowing sufficient length for the hooked end to project out of the mucous membrane. The tooth is packed off with gauze, the pin hole dried with paper points and cement is run into the pin hole with a root canal filler. *Fig.* 7. The pin is set in a position and packed with gauze until the cement has set. During this period the appliance is fitted and when the cement has dried the fine wire spring is attached to the hook. The area is packed with sterile vaseline gauze, which is changed every three days for about two weeks.

The appliance takes six or more months to bring a tooth into alignment.

3. A MODIFICATION OF THE APRON SPRING TO RETRACT AND ALIGN UPPER ANTERIOR TEETH

The spring is made from .6 mm S.S. wire and bent in the form of an apron spring, but with a single turn round the high labial bow. The tension is supplied by a coil spring wound in .3 mm S.S. wire at each end. *Fig.* 8.

Acknowledgment.

My thanks are due to the Photographic Dept., Guy's Hospital Dental Department.

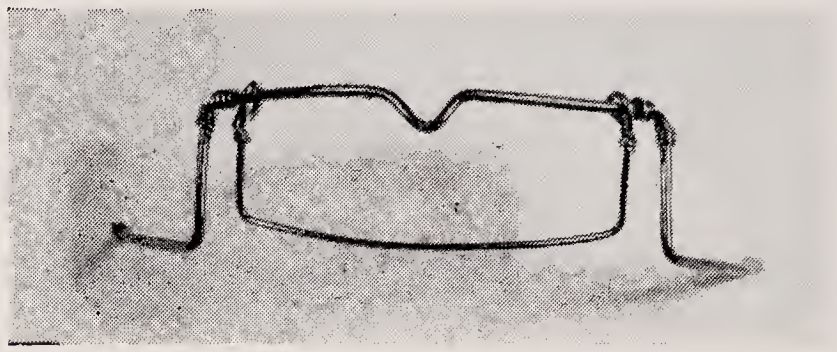

Fig. 8

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A WORKING MODEL TO AID IN TEACHING ORTHODONTIC DIAGNOSIS

By J. H. HOVELL, L.R.C.P., M.R.C.S., F.D.S. R.C.S.

A model was constructed approximately twice life size, of the dental arches in occlusion, in which the crowns and apices of the teeth were capable of independent movement. Thus, the antero-posterior relationship of both dental arches and apical bases could be varied independently of each other. In addition, the crowns of the upper and lower incisors were maintained in alignment by elastic bands externally, to represent the lips, and by an inflatable balloon internally, to represent the tongue. It was possible, therefore, to demonstrate the aetiology of the production of various types of malocclusion, due to ;

A. Apical base relationships, by varying the position of the apical bases, and,

B. Faulty muscle action or posture, by varying the position and/or tension of the elastics and balloon.

For example, a typical Angles Class II Div. I malocclusion, with all its typical features, was readily produced from a normal occlusion, without in any way altering the apical base relationship.

* * * * *

SOME INTERESTING CASES

By Miss JOAN RITCHIE, L.D.S.

Fig. 1. Class I (Angle) with rotation of upper incisors treated with one removable appliance.

Fig. 2a.

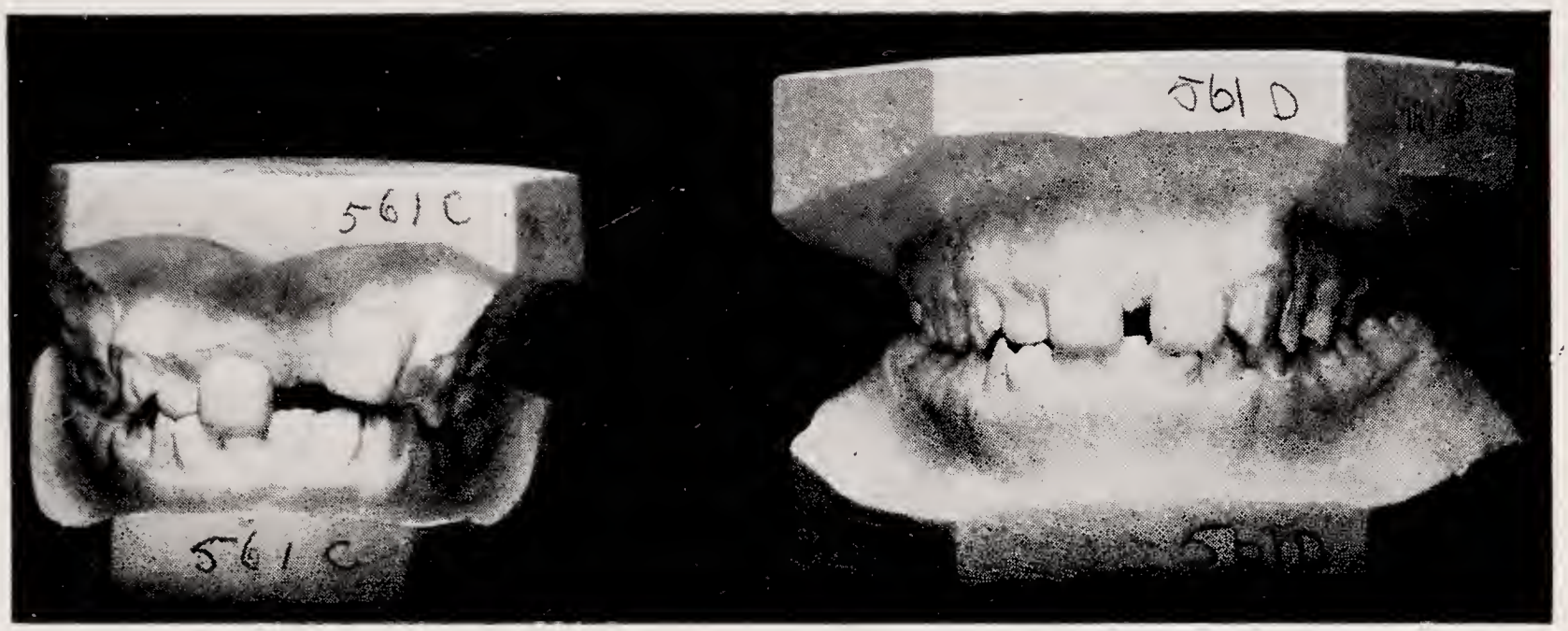


Fig. 2b.

Fig. 2. (*a*) & (*b*) Mutilated Class I with supernumerary tooth in position of $\underline{|1}$ which is erupting labially to $\underline{|2}$ and with $\underline{|3}$ erupting buccally to $\underline{|4}$.

Treatment by removal of supernumerary and extraction of $\underline{|2}$, followed by the use of a modified Twin Wire Arch. Case still under treatment.

Fig. 3a. Front view of case.

Fig. 3*b*. Side view of case.

(*c*) Skeleton view of type of appliance used in the lower arch, made up prior to extractions.

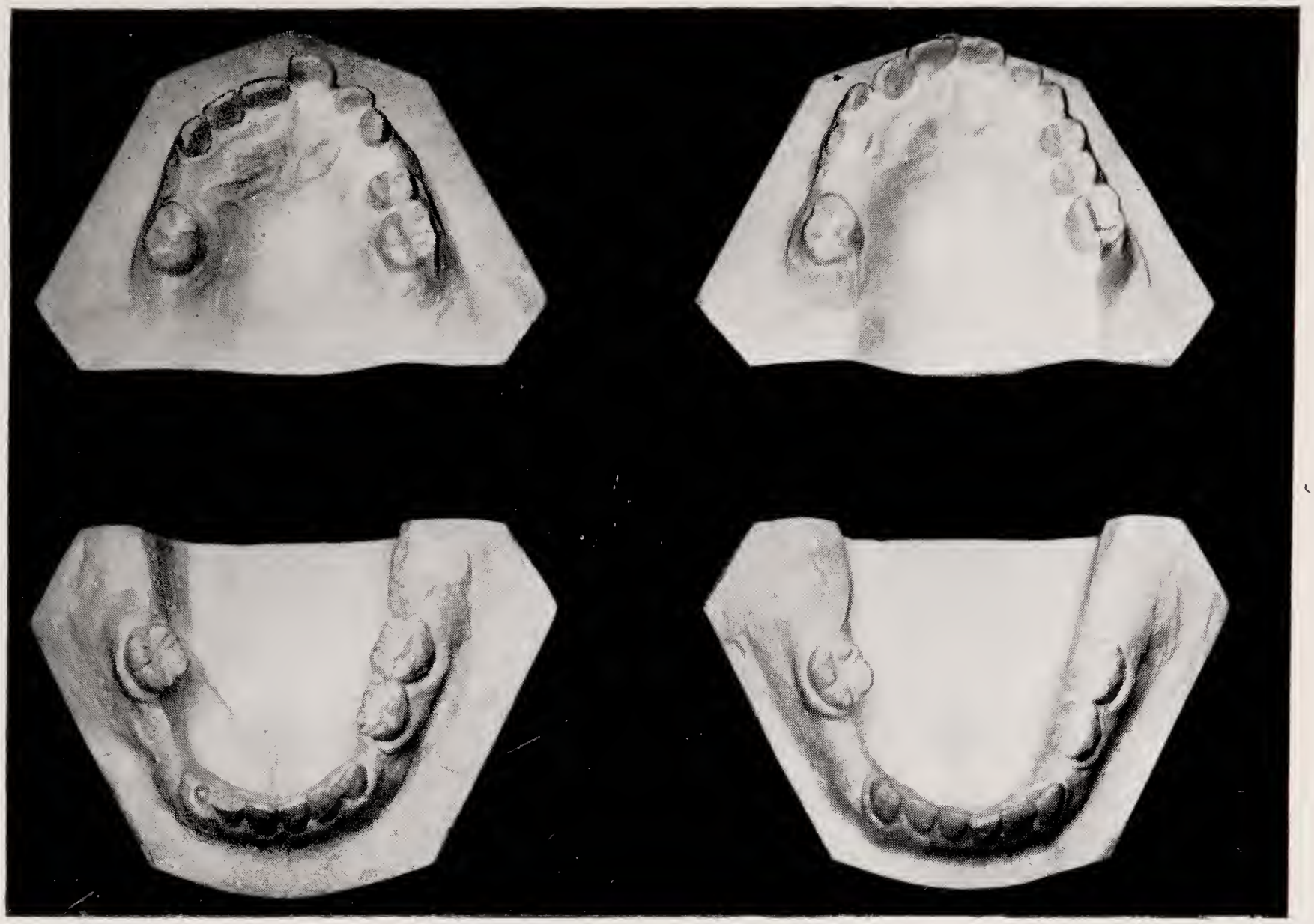
Fig. 3. Class II Div. I case with carlier unilateral extractions of $\frac{4}{4}|$. Treatment extraction $\frac{4}{4}|$ and retraction $\frac{3}{3}|$ followed by alignment of $\frac{21|12}{21|12}$, case now on retention.

Fig. 4. Patient fitted with fixed appliance in February 1948. In August, underwent two nasal operations with appliance *in situ*. Seen again, November 1948 with appliance still in position.

Left photograph shows appliance refitted on original working model.

Right photograph shows position of $\underline{|6}$ immediately after removal of distorted appliance.

Fig. 5a.



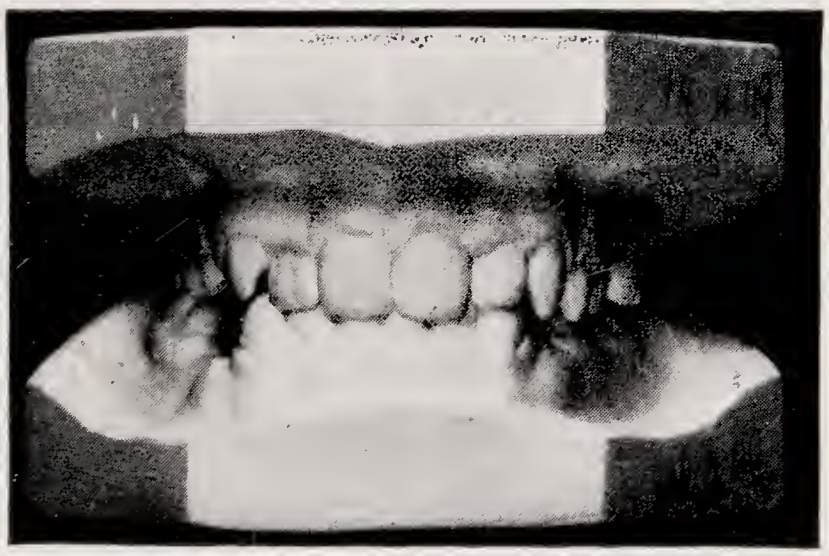


Fig. 5. Class I case with $\underline{621|}$ biting lingually and loss of space for $\underline{54|4}$. Treated with one appliance.

(*a*) View of models from above.
(*b*) Front view of case on retention.
(*c*) Appliance used.

Fig. 1

SOME ORTHODONTIC PROCEDURES

By Miss ROSAMUND CASELEY, L.D.S., R.C.S.

This Demonstration showed many good results, particularly of upper incisor alignment with and without extraction of premolars.

The following are some of the cases shown :

CASE 1 shows good results after extraction of $\frac{4|4}{5|5}$ the only appliance used being an oral screen.

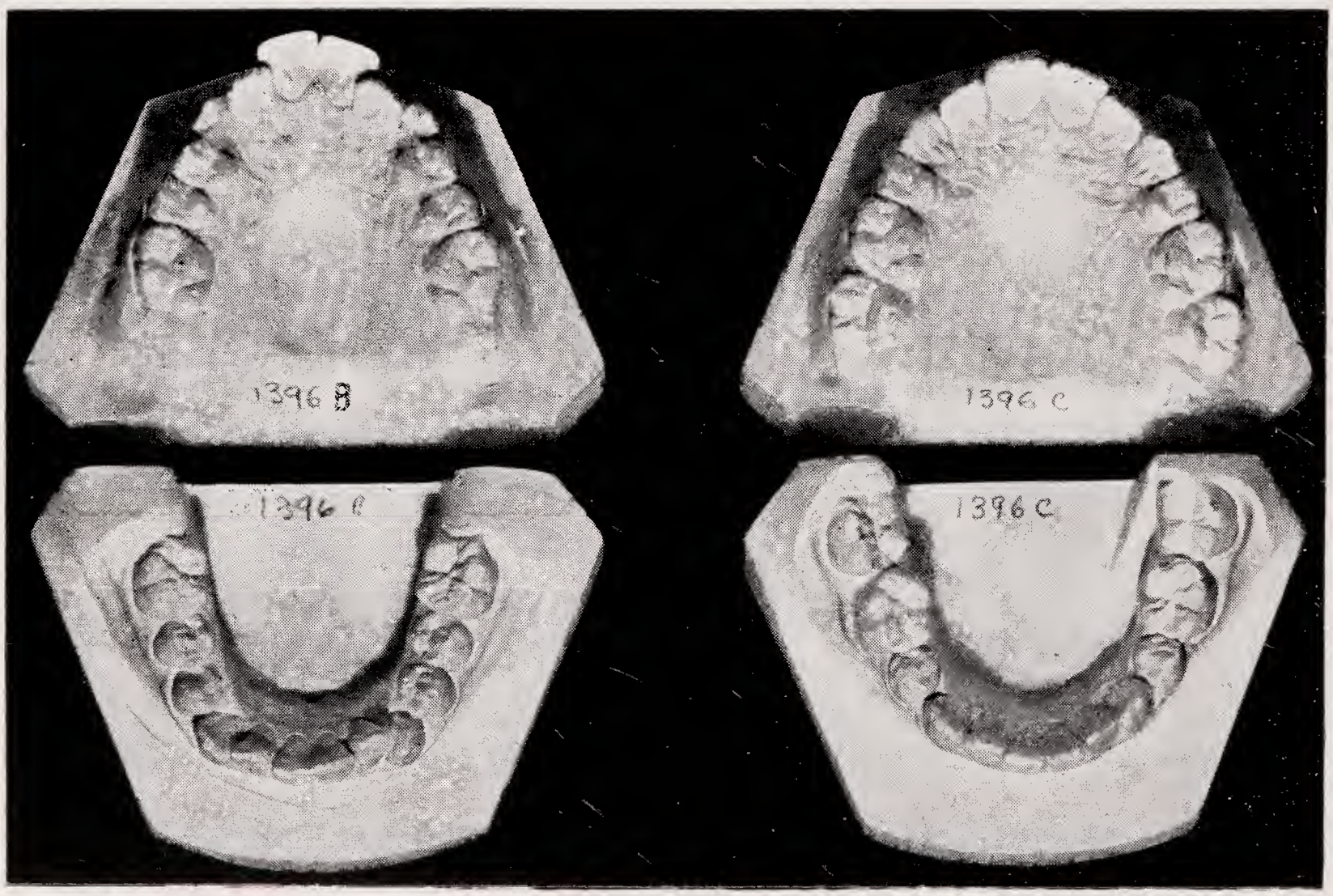


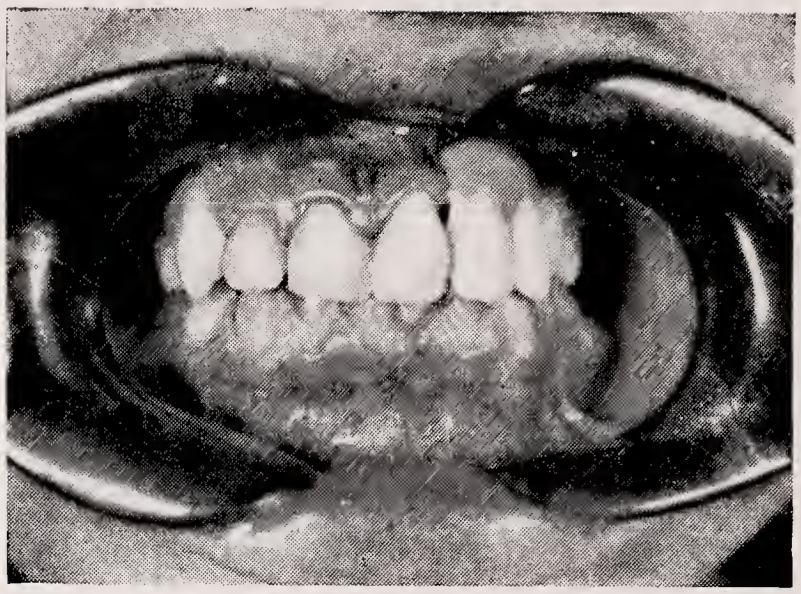
Fig. 2

Fig. 3

CASE 2 shows a Class III case. This case was treated first by a lower inclined plane, followed by an upper linguo-labial arch and coil springs for antero-posterior expansion.

CASE 3 shows improvement in alignment of upper incisors after wearing an upper plate with Badcock screw used to push left buccal segment distally.

Fig. 4



CASE 4. Left-sided complete cleft and hare lip. This was treated with an upper twin arch and a lower lingual arch, the alignment of incisors being maintained by the prosthetic appliance used to replace $\frac{|}{23}$

Fig. 5

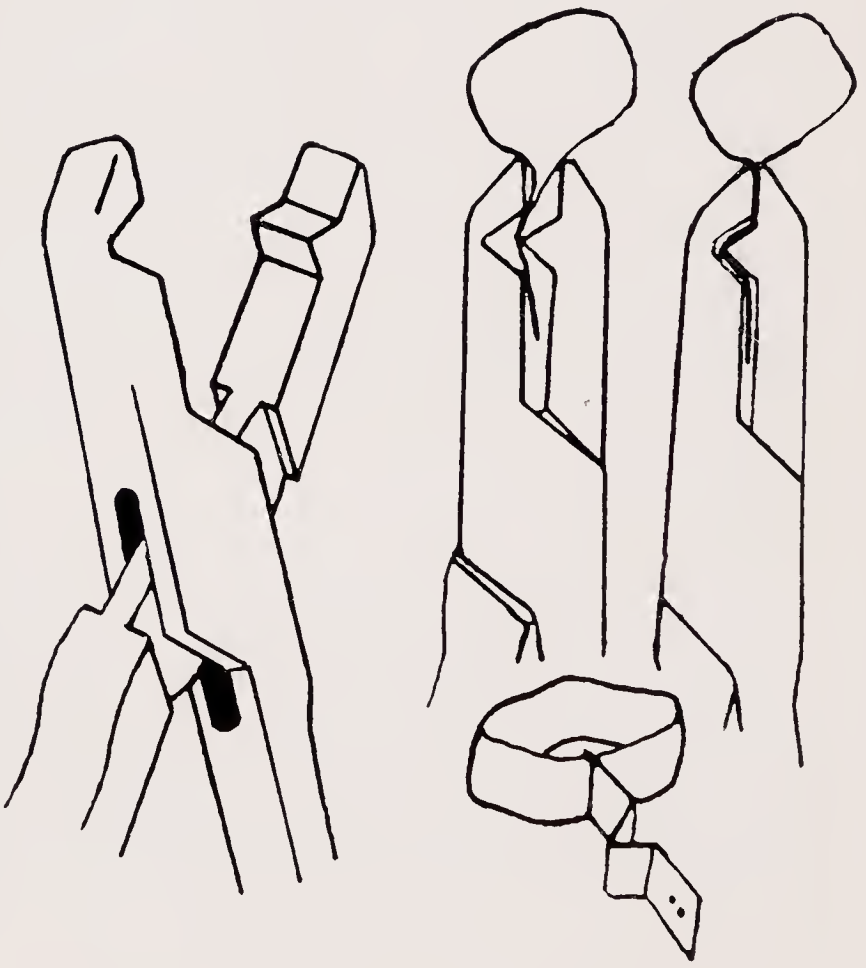
* * * * *

A BAND FORMING PLIERS

By R. ERNEST RIX, L.D.S., F.D.S. R.C.S., M.R.C.S., L.R.C.P.

THE BEAKS OF THE PLIERS hold the free ends of band material with a force not obtained with pliers whose opposing surfaces are flat. Friction is introduced by requiring the free ends to bend over the angles of a triangle and, in the act of gripping the forceps, the band is stretched tightly around the tooth, tightly enough to impart some degree of contour.

The beaks are 5 mm. broad. The apex of the triangular bar is 2.5 mm. from its base. The distance from the tip of the beaks to the edge of the triangle is 3.5 mm. When the pliers are closed there is .5 mm. clearance between the beaks from the joint up to and including the angle of the triangle nearest the end of the beaks. This allows for the double thickness of band material to be accom-



modated without the ends of the beaks being gagged apart.

In making anchor bands on the first permanent molar 5.5 cm. approximately of stainless steel tape .5 x 0.15 mm. is used. The middle portion of the strip needs to be contoured with contouring pliers to a simple longitudinal bulge, and the free ends are joined together with two spot welds. The loop is passed round the tooth and is so adjusted that the welded end lies in the region of the antero-buccal cusp. Digital pressure is used to push the band into contact with the lingual surface of the tooth. The beaks are opened to embrace the free end, and the long axis of the pliers is held at right angles to the surface of the tooth in the region of the antero-buccal cusp. Closure of the forceps with the beaks pressed hard against the tooth, causes the band to be drawn up tightly. The excess material is cut away and the band lapped and welded in the usual way. For those who care to modify the final cutting and lapping of the joint of the band, the square ends of the beaks can be made concave to approximate the curve of the buccal surface of the tooth and so improve contouring still more.

* * * * *

Demonstrations by Orthodontic Department of Liverpool Dental School.

THE MODIFIED ARROWHEAD CLASP

C. P. ADAMS

THIS CLASP, while in appearance resembling an arrowhead clasp in a rather abbreviated form, in fact functions on the principle of the Crozat clasp.

The small, neat arrowheads grip the tooth mesially and distally on the buccal surface taking advantage of the slight undercuts existing there that are not present at the same level in the centre of the buccal surface.

ADVANTAGES.

1. May be used on molars, deciduous molars, premolars or canines.
2. A firm grip is obtained on a tooth even in a state of semi-eruption without the use of a lingual spur.
3. No specialised pliers are required for construction of the clasp.
4. A single piece of wire is used, so making for strength.
5. Traction hooks can be incorporated.

CONSTRUCTION.

1. If the tooth to be clasped is not fully erupted, the plaster "gum" should be trimmed slightly back at the points where the arrowheads impinge *while at the same time preserving most carefully the shape of the tooth itself.*
2. The clasp is then formed up to stage 3 in 0.7 mm. hard stainless steel wire, using a pair of fine short nosed pliers.
3. The arrowheads are then adapted to the tooth and are slanted to correspond to the slope of the gum margin.
4. The tags are carried over the contact points into the palate.

IMPORTANT POINTS.

1. The arrowheads must not touch the neighbouring teeth.
2. The bridge between the arrowheads must stand quite clear of the tooth and gum.
3. The tags must be carried over the contact points *even though the adjoining teeth are not present.* It is this arching of the tags that gives the clasp the slight resiliency required. *(See Fig. 2)*
4. Final adjustment of the tension of the clasp is made in the mouth by bending the wire where it crosses the contact points so as to tighten the clasp.

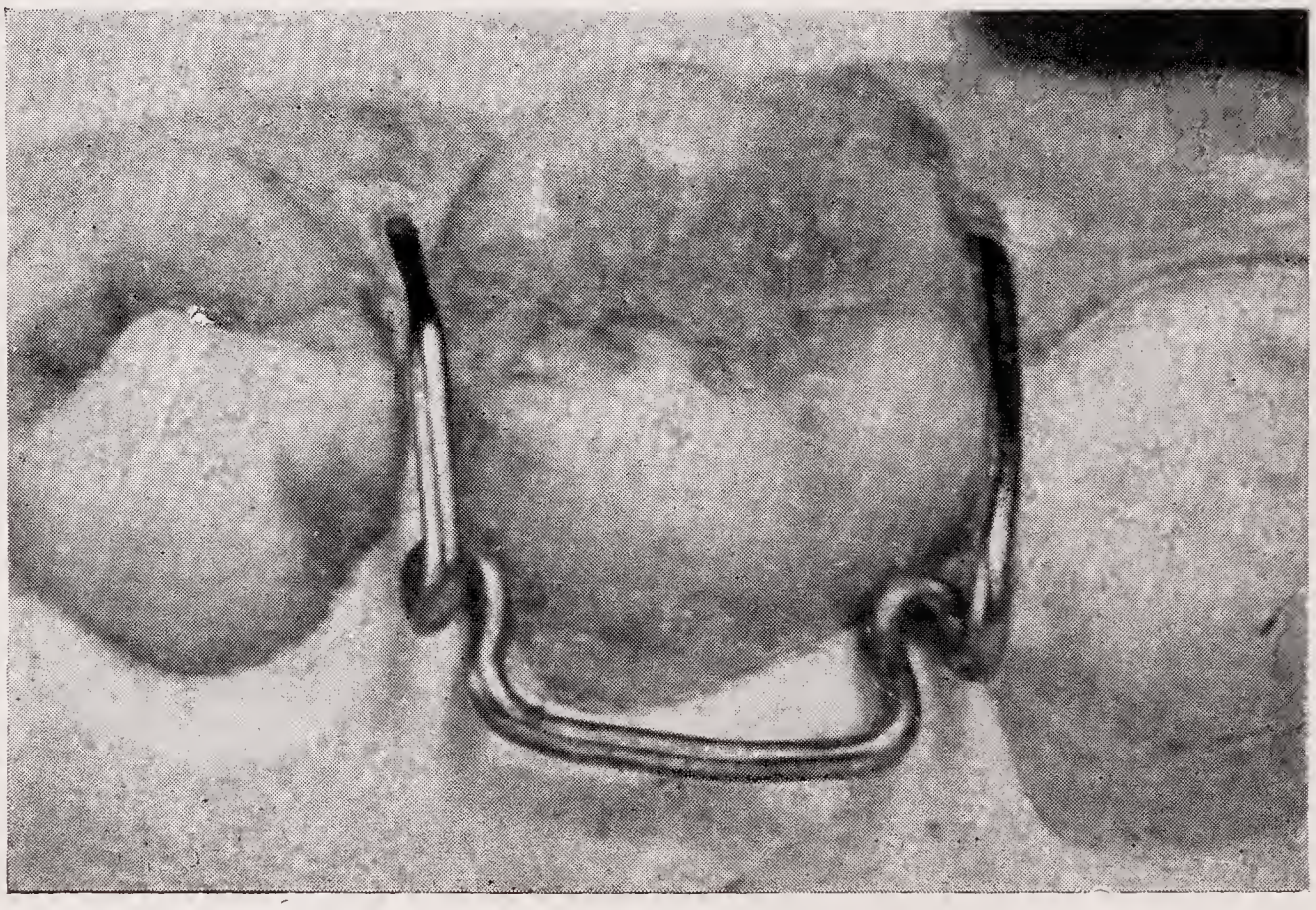


Fig. 1
BUCCAL VIEW

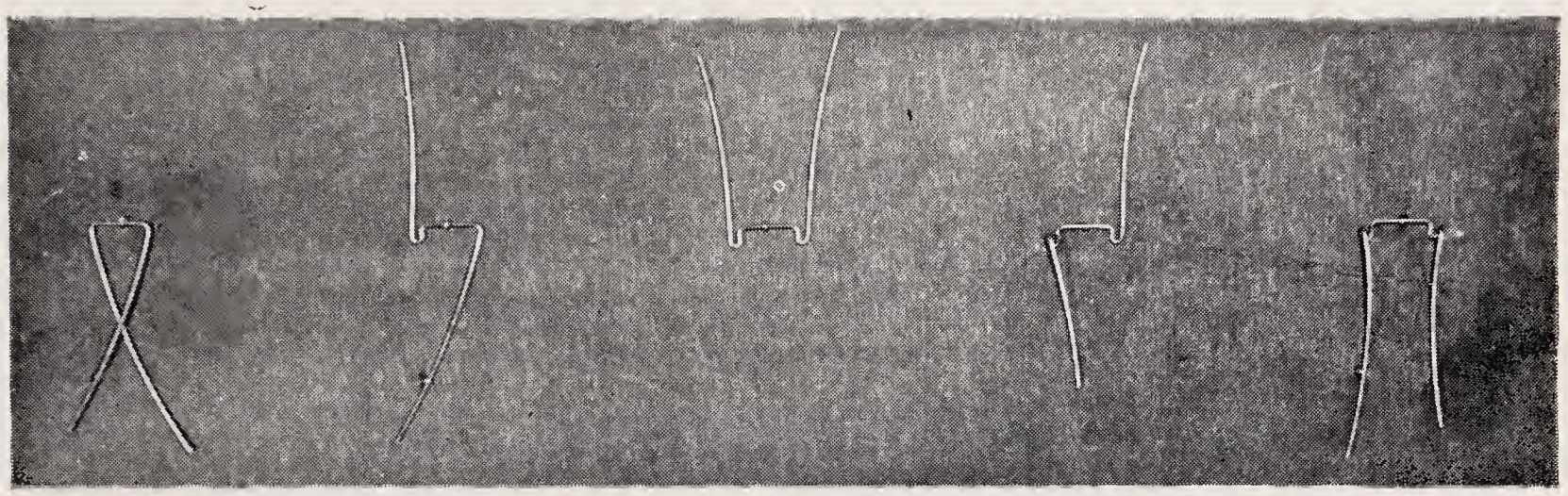
Fig. 2.
MESIAL VIEW

Notes :—

1) Tags arch over contact point even though neighbouring tooth is absent.
2) Simplified retention of tags in baseplate, this also stabilises the clasp during packing of the baseplate material.

Fig. 3.
STAGES IN FORMATION

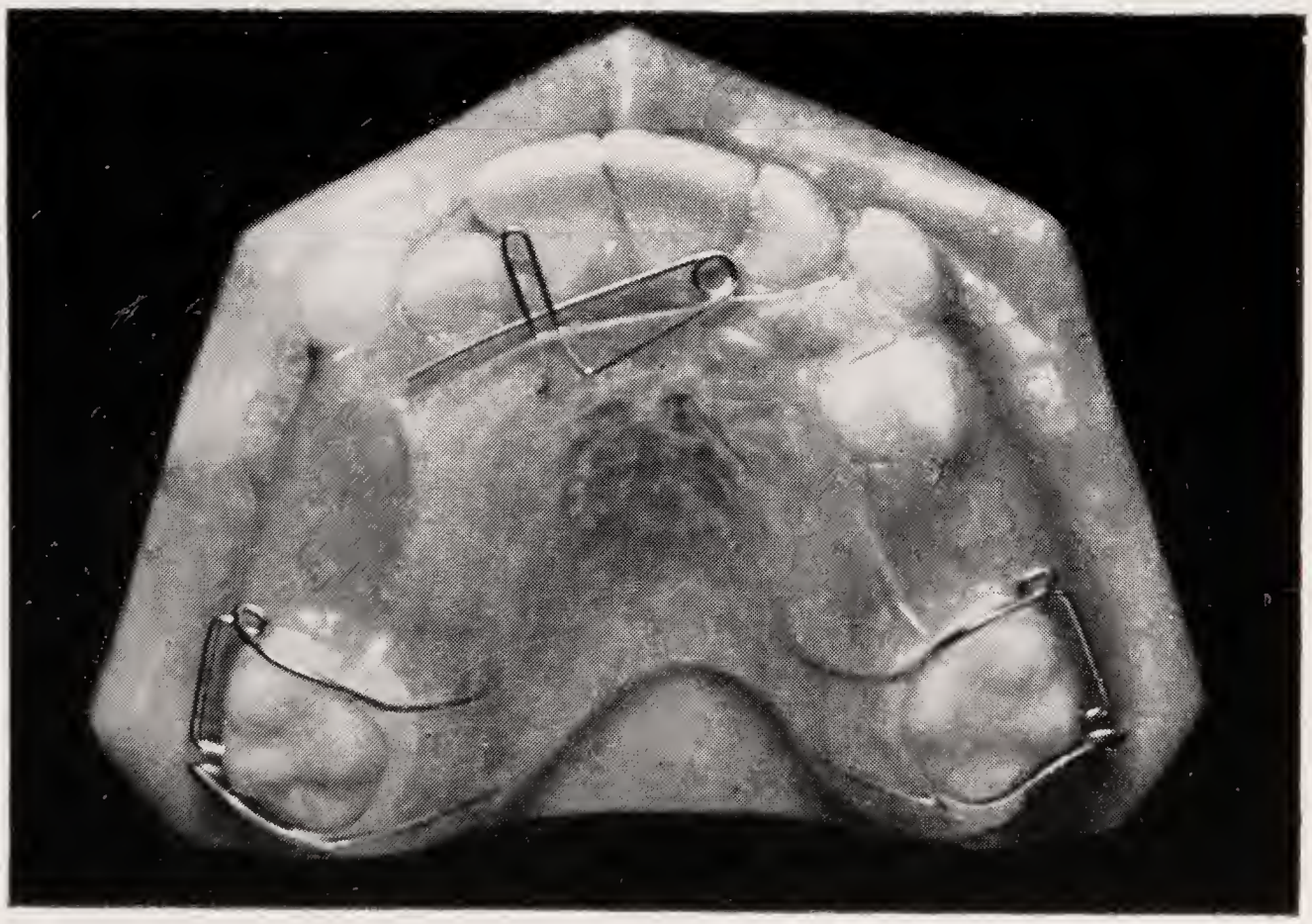
Use 0.7 mm. hard wire.

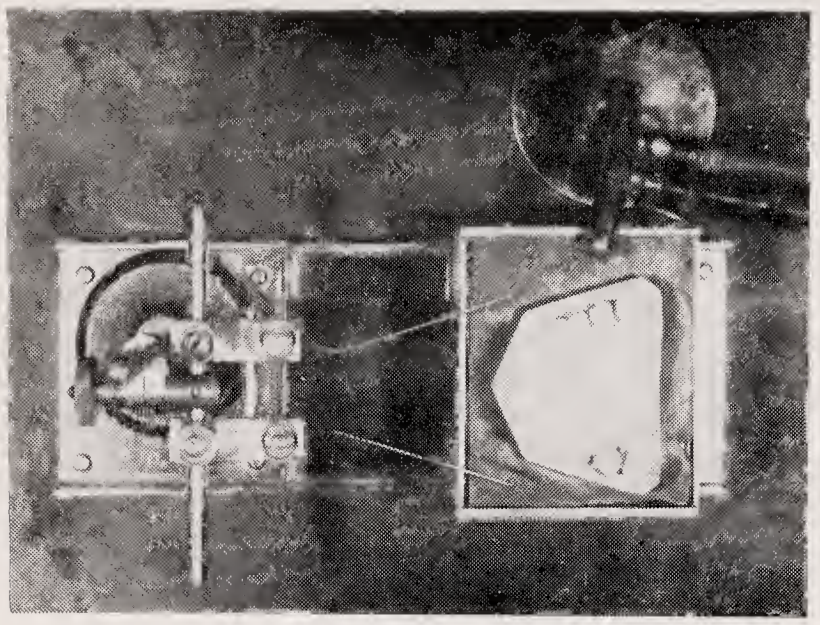


1 2 3 4 5

Fig. 4.
CLASPS IN POSITION

In a plate of this particular type it is imperative to have the clasps as far forward as possible. In the absence of claspable teeth in front of $\underline{6|6}$ these clasps applied to $\underline{6|6}$ will generally retain such a plate in position, but if there are teeth further forward these should be used.





APPARATUS FOR LINING UP AND SOLDERING INTER-MAXILLARY TUBES.

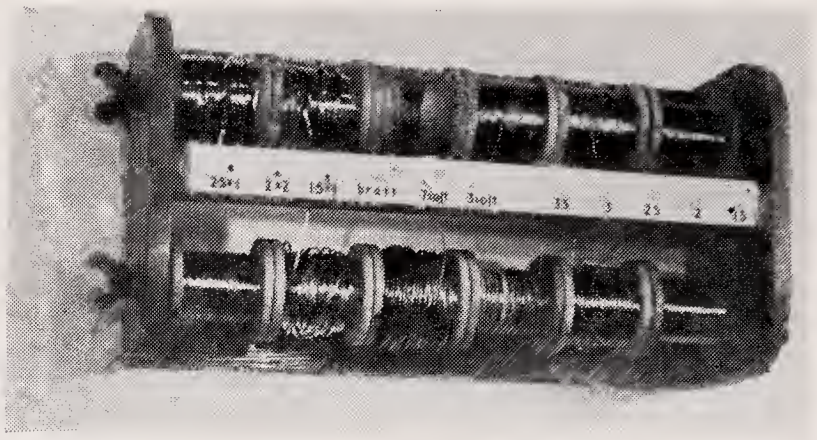
(Mr. W. Burston).

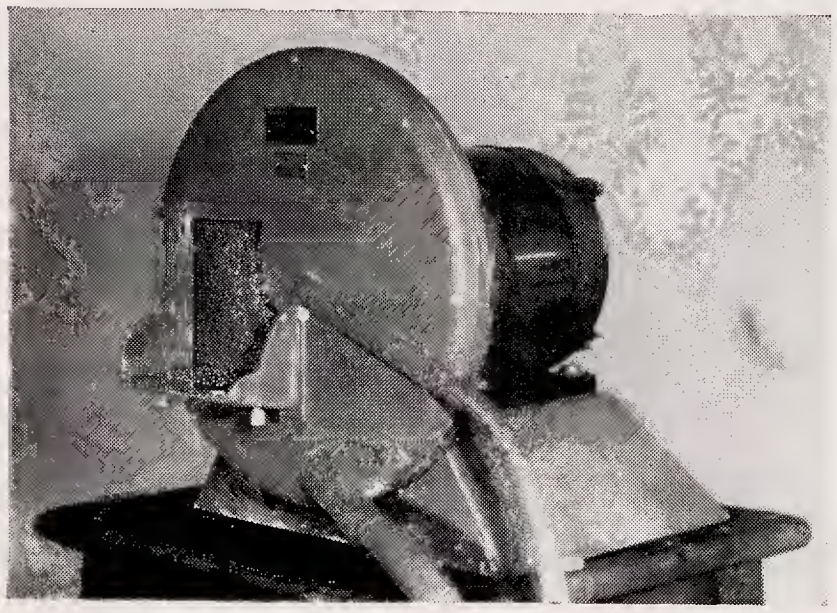
The apparatus consists of a base, a sliding carriage, and a stand. The model is held on the carriage by moldine. The stand carries wires which hold the tubes in position while soldering. The wires are adjusted by thumb screws to suit the particular conditions of the case.

WIRE DISPENSER.

Designed by Mr. F. D. Rowe.

The illustration is self explanatory. The apparatus takes 12 two inch reels. It can be used for hard wire up to .35 mm. and for the smaller sizes of tape.





MODEL TRIMMER.

Mr. J. W. Sotfley.

(Made to Mr. J. W. Softley's design).

LEAD SEALING PLIERS, ADAPTED FOR MAKING ORTHODONTIC ATTACHMENTS.

Mr. J. W. Softley.

These pliers are extremely powerful and easy to operate.

The illustration is shown with dies for making anterior twin-arch locks. The band material fits accurately between the two outer arms of the ' W,' which are longer in the stamping. This ensures rapid and accurate centreing of the attachment.

Mr. F. D. Rowe.

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CONGENITAL ABSENCE OF PERMANENT MOLARS

By MURIEL E. H. DAVIS, L.D.S. (Birm).

OLIGODONTIA, or partial anodontia, is a condition where there is a congenital absence of some of the teeth only. It usually manifests itself in the permanent dentition, but it occasionally occurs in the deciduous dentition. In many cases there is a history of missing teeth in other members of the family involved.

According to Salzmann the permanent teeth most commonly missing in this condition are, in the order of frequency :—

Maxillary lateral incisors
Mandibular second premolars
Maxillary second premolars
Mandibular central incisors
Maxillary first premolars
Mandibular lateral incisors
Mandibular first premolars
Maxillary third molars

Beiderman, however, states that the third permanent molar is the most frequently congenitally missing tooth.

First molars, mandibular canines and maxillary central incisors are seldom missing.

Embryogically it would seem that there is a close relationship between the presence or absence of the first permanent molar and the second and third permanent molars. The enamel organ of the first permanent molar is derived from a prolongation backwards of the true tooth band, from which further prolongations develop the enamel organs of the second permanent molar, at about the third or fourth month, and that of the third molar at approximately the third year after birth.

In a paper entitled "Congenital Absence of First Permanent Molars" by McCall and Samuels the view is expressed that even in cases of severe anodontia the first permanent molars are usually present. They state that it is difficult to account for the presence of the second molar when the first is missing if the bud for the second permanent molar is given off from an extension of the dental lamina of the enamel organ of the first permanent molar. The evidence seems to show that this can happen and they surmise that either the dental lamina grows past the location of the first permanent molar and gives off a bud for the second permanent molar or that a bud is given off for the first permanent molar which then itself fails to calcify and is absorbed.

In cases where the first permanent molar is missing there are likely to be other teeth missing as well.

The points of diagnostic importance in cases of congenital absence of first permanent molars are :—

1. The state of development of second and third molars as shown on a radiograph in relation to the chronological age.
2. The anatomy of roots as shown on a radiograph.
3. The anatomy of crowns as seen in the mouth.
4. The position of the second molars; these teeth tend to erupt distally to the position that the first molar would normally occupy, and move forward before and after eruption with a slight but definite tilt medially.

In the four cases described by McCall and Samuels, one showed missing upper lateral incisors and missing lower centrals, while the other showed conical upper lateral incisors and missing third molars in addition to the missing first permanent molars.

The two cases I have to report are :—

Case 1

This patient was a healthy, well built, girl of twelve years of age. She had a well cared for, caries-free, mouth with no history of extraction except the upper

Fig. 1

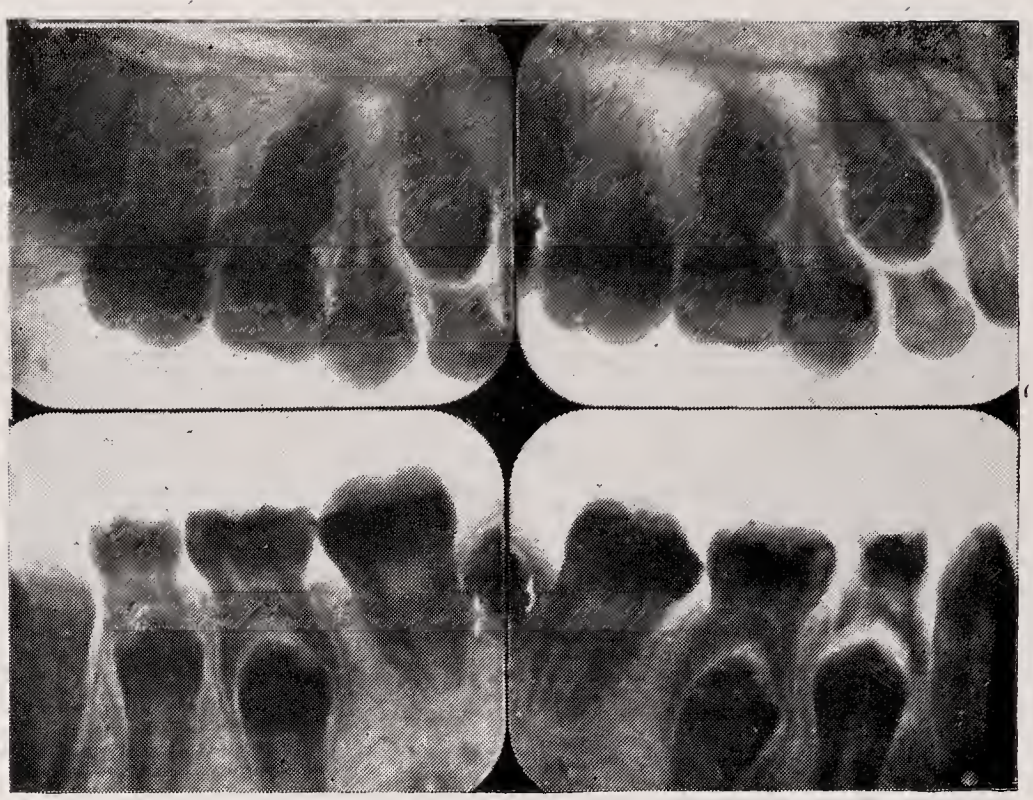


Fig.2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

deciduous incisors. On examination she was found to have good arches with rather a close bite and the

$$\frac{7 \text{ or } 6\ E\ D\ C\ 2\ 1 \mid 1\ 2\ C\ D\ E\ 6 \text{ or } 7}{7 \text{ or } 6\ E\ D\ 3\ 2\ 1 \mid 1\ 2\ D\ E\ 6 \text{ or } 7}$$

were present (*Fig.* 1). The lateral incisors were normal in shape and size. The crown surfaces of the lower erupted permanent molars had four cusps only, the distal cusp in both cases being absent. The mediobuccal and the mediolingual triangular ridges run horizontally across the tooth width which is characteristic of the second molar, whereas the medial triangular ridges of first molars run obliquely toward the central fossa. The lower right permanent molar has a distinct medial tilt and neither this or the lower left permanent molar were fully erupted.

The distolingual cusp of the upper left permanent molar is absent giving a tritubercular appearance and there is no clearly defined oblique ridge joining the mediolingual cusp to the distobuccal cusp.

Radiographic examination at 12 years, 9 months, showed the presence of the permanent canines, premolars and only two molars in each quadrant of the mouth. The unerupted molars in the series have the crowns formed only, which is the normal state for the third molars at this age. The roots of the erupted molar teeth appear to be less divergent and similar in form to second permanent molars and the apices seem to be open (*Figs.* 2, 3 *and* 4).

Case 2

This patient, a girl of 19 years of age, has always had careful dental supervision. She has good arches with normally shaped teeth. Those teeth present are:

$$\frac{-\ 7\ 6\ 5\ 4\ 3\ 2\ 1 \mid 1\ 2\ 3\ 4\ 5\ 6\ 7\ -}{8\ -\ 6\ 5\ 4\ 3\ 2\ 1 \mid 1\ 2\ 3\ 4\ 5\ 6\ -\ -}$$

It is interesting to note that the right lower third permanent molar has not moved forward to fill the gap left by the non-development of the second molar (*Figs.* 5 *and* 6).

Conclusions

Widdowson states that in 76 per cent. of mandibular molars the first permanent molar has five cusps, the second permanent molar has four cusps and the third permanent molar has five cusps. In the other 24 per cent. of cases there are five cusps on each tooth.

From the evidence given in *Case* 1 it would appear that what at first sight are $\frac{-\mid 6}{6 \mid 6}$ are in fact $\frac{\mid 7}{7 \mid 7}$ and that the developing crowns of the second molar in the series are those of the third permanent molars: this is borne out

by the fact that their state of development is normal for third molar teeth at the age of 12 years.

Case 2 shows that it is possible for a second lower permanent molar tooth to be missing and for the third molar to be formed in approximately the same position as it would have been if the second molar had been present.

It is interesting to speculate whether or not congenitally missing molars are more common than is usually believed, and that possibly when the first permanent molars appear to be missing it is taken for granted that it has been extracted. Obtaining an authentic history in many cases makes investigation difficult.

References

J. A. Salzmann. *Principles of Orthodontics.*

T. W. Widdowson. *Special or Dental Anatomy and Physiology and Dental Histology.* Vol. 1.

J. O. McCall and I. M. Samuel. Congenital Absence of Permanent Molars, *Dental Items of Interest*, April, 1943.

* * * * *

DISCUSSION

The President said that the members were very grateful to Mrs. Davies for her communication.

He was particularly interested in the case of the missing lower 12-year old molar in which the third molar had not moved into position at all. He had never met such a case in his experience.

Miss L. M. Clinch said that she would like to show some slides of a case similar to those described by Mrs. Davies.

She had seen the patient at the age of 8 years, and at that age she had no permanent molar on the lower left side. There was no history of extraction either from the child herself or from the dental surgeon who had always attended her. The models shown in the slide were taken when the patient was 14 years of age. She had then only one molar on the lower left side, and it looked much more like a second molar than a first molar.

The slide showed X-rays of the upper and the lower on the other side, taken at 14 years of age. The patient then had only two molars, and the third molars, the unerupted molars, appeared to be in the stage in which third molars normally would be at that age. Whether the erupted molar was the second molar or not she would not like to say.

The slide showed the side where there definitely were missing teeth. There was a missing premolar and there were only two permanent molars, which looked much more like second and third molars than first molars.

She thought that, as Mrs. Davies said, cases of missing first permanent molars were not so very uncommon, but perhaps orthodontists were not as observant as they might be, or possibly their dental anatomy was not as good as it ought to be.

She would like to thank Mrs. Davies very much indeed for bringing to the attention of the Society the cases which she had described in her communication.

* * * * *

TREATING CASES WITH REMOVABLE APPLIANCES

By J. R. DIMOCK, L.D.S., R.C.S.

THIS EVENING I have brought along one or two cases treated by perhaps the simplest of all methods. On my way home after the last clinical meeting, I remarked to a friend that what we had seen made my orthodontic methods seem very crude in comparison. He agreed with this opinion and so it occurred to me that perhaps I might be bold enough to produce cases of this nature as there might also be others who had neither the time nor the equipment with which to make elaborate apparatus.

I only spend a limited amount of time on orthodontics and both in hospital and in private practice I only have the assistance of a technician for removable appliances. If I make a fixed appliance I probably have to take up surgery time on mechanics or else become unpopular by taking the working models home with me. Therefore, if I can keep away from fixed apparatus I can treat more cases in hospital and by cutting down surgery time can reduce the cost of private treatment.

The following cases *Figs.* 1 and 2 are illustrations of moving forward lower incisors with removable plates.

Case 1. Patricia (*Fig.* 1).

Unfortunately the top model was taken a year and four months before the treatment commenced but $\overline{3}|$ came through in almost exactly the position of $\overline{C}|$ as seen here.

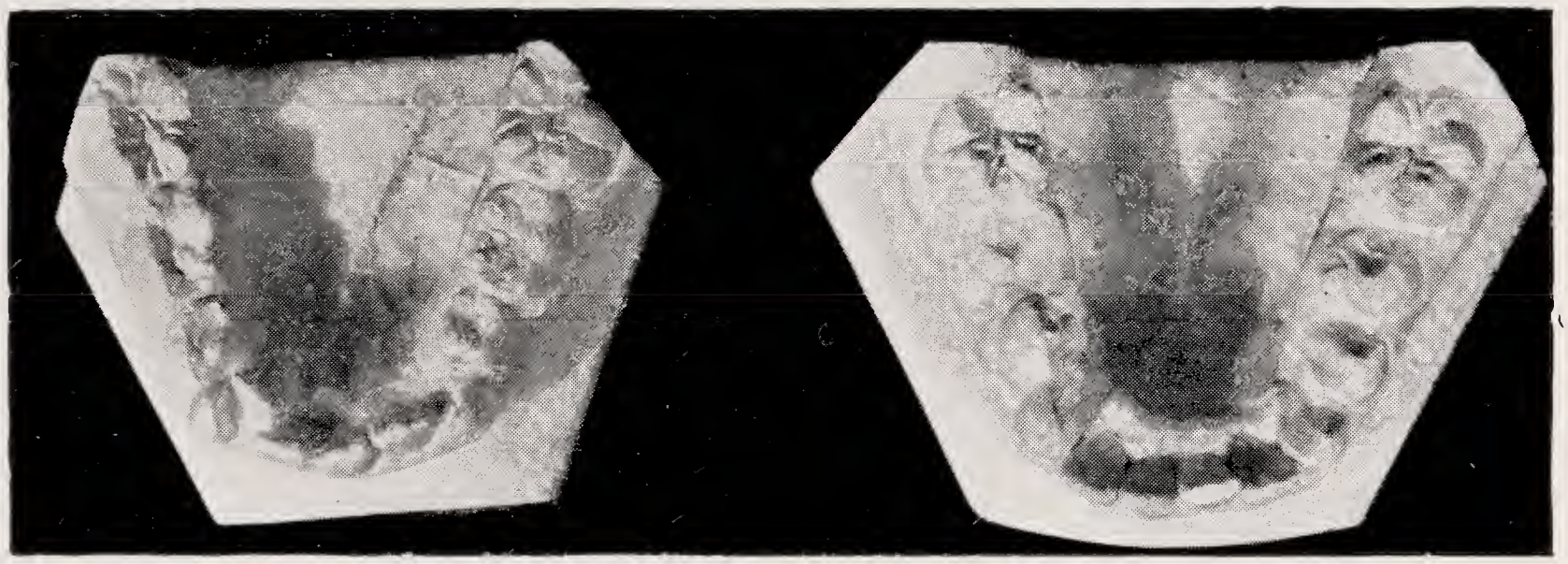


Fig. 1

Fig. 2

The apparatus used had Visick's spurs and cribs on $\overline{6|6}$ and two free ending springs to the lower incisors.

The patient was $10\frac{1}{2}$ when this lower plate was fitted. Active treatment took $7\frac{1}{2}$ months during which time there were only five visits for adjustments. The plate is still being worn in a passive capacity to hold $\overline{6|6}$ back.

Case 2. Michael (*Fig.* 2).

A complicated case needing reduction of teeth both in the upper and lower jaws. In the lower both temporary canines and the permanent right central were removed and a plate was fitted about a week later. Visick's and cribs were fitted to $\overline{6|6}$ and as extra stability was desirable additional Visick's and free ending clasps were fitted to $\overline{\text{E}|\text{E}}$. Two buried free ending springs were made to act on the three remaining incisors.

Active treatment took four months during which time there were three visits for adjustments.

Michael was 11 2/12 when treatment was commenced. A lower retention plate was worn for about 18 months and the second model was made when this was discarded. This boy was a very good patient and had to start off with upper and lower appliances which were an awful mouthful. I do think in similar cases a lower fixed apparatus is better tolerated.

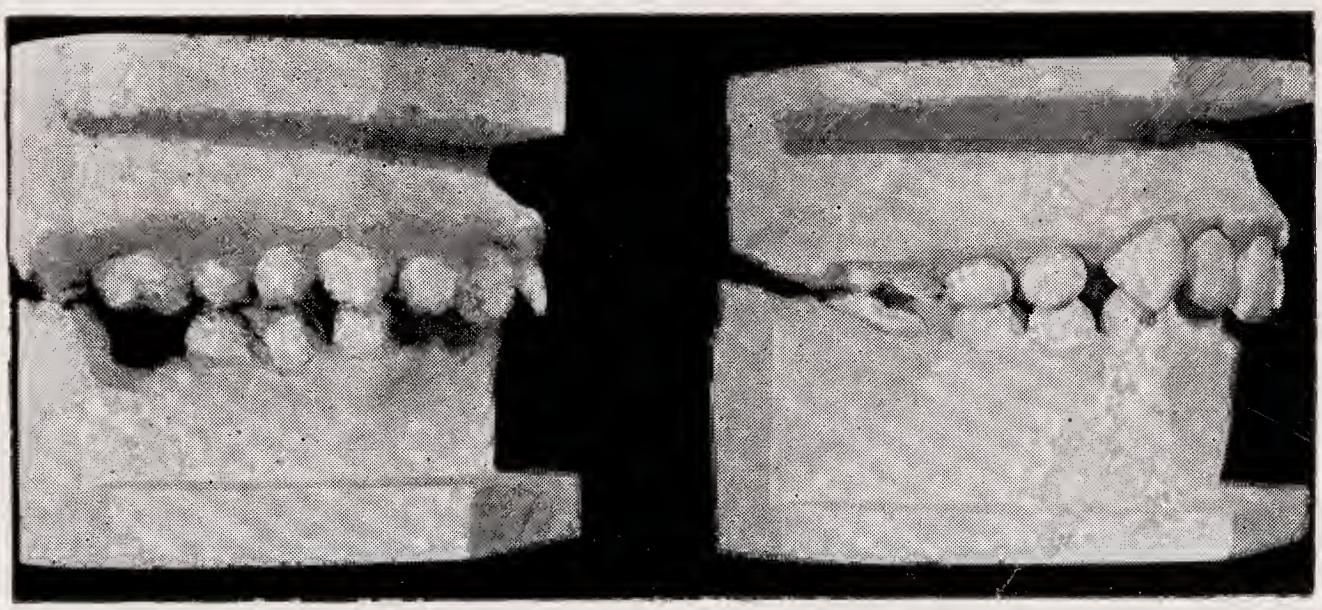


Fig. 3

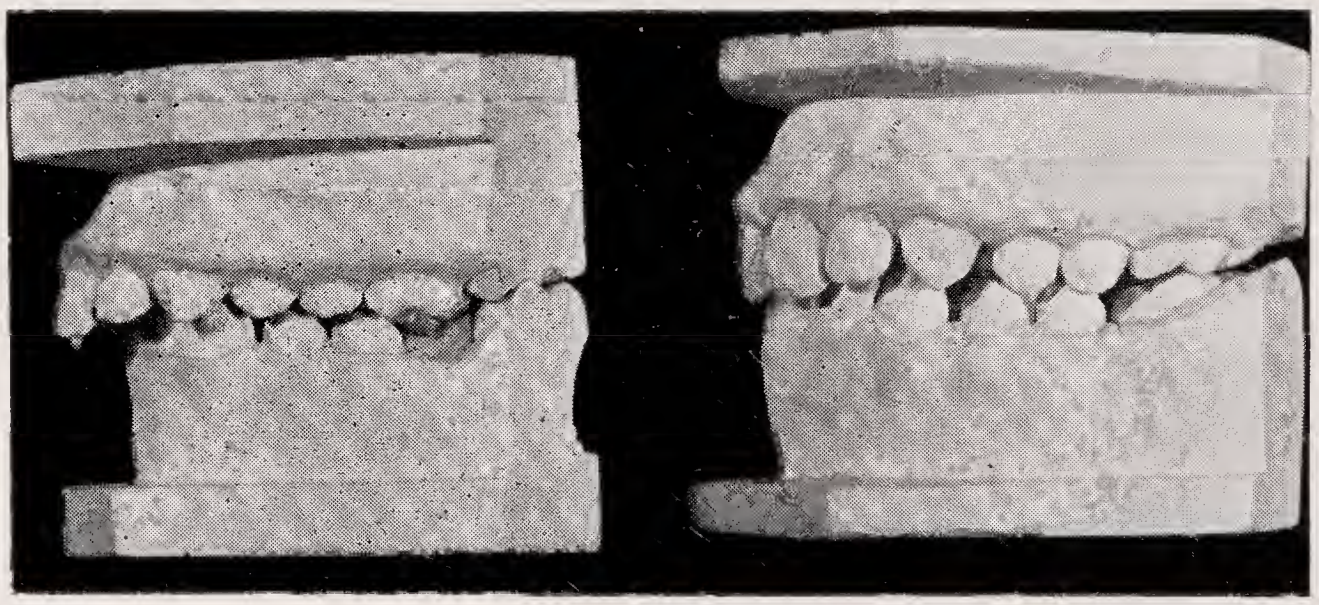


Fig 4

Case 3. Gillian. Age 12 5/12 (*Figs.* 3, 4 & 5).

Gillian when first seen had a very neglected mouth. There was caries all over the place and the gum condition was poor. $\overline{6|6}$ were missing and the cheek teeth were one unit postnormal. Treatment was commenced at once. $\underline{6|6}$ were extracted and conservative treatment completed within a short time.

Two upper removable appliances were used. The first one had a buccal bow and

buried palatal springs to $\frac{54|45}{}$. An anterior inclined plane was used to open the bite. First of all $\frac{5|5}{}$ were moved back and then retained whilst $\frac{4|4}{}$ were being similarly moved. $\frac{3|3}{}$ followed $\frac{4|4}{}$ without assistance. This stage took one year during which time there were nine visits for adjustments.

The second plate was saddle shaped. It had a high labial bow carrying a fine wire spring to press back $\frac{21|12}{}$. This plate was worn at night only for 4 months when it was discarded and the second set of models taken. Gillian was last seen three months later and the alignment of the anterior teeth was tending to improve. The slight relapse of the premolar relationship on the right hand side occurred during the second part of the treatment.

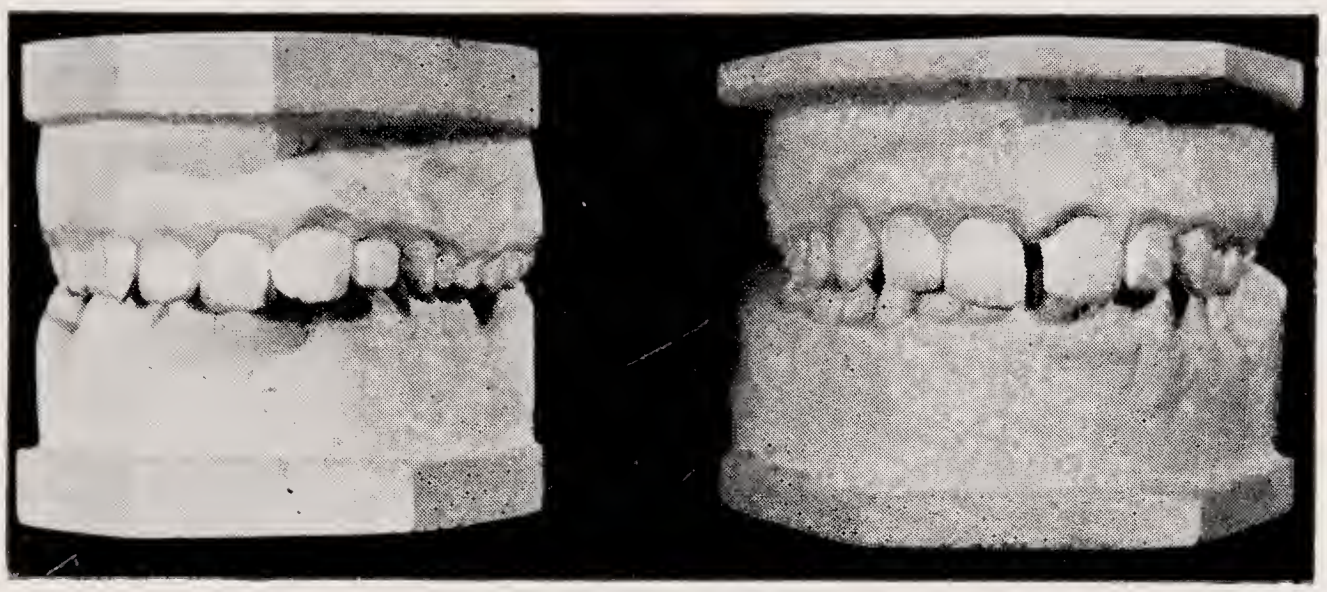


Fig. 5

Case 4. Mabel (*Figs.* 6, 7 & 8).

This is another case of movement of upper teeth. The patient was $16\frac{1}{2}$ years of age when treatment was commenced. Active treatment took one year. Retention by night only was continued for 6 months and the second models were taken six months after retention had been discontinued. Unfortunately, in this interval $\frac{|6}{}$ had to be extracted because of apical infection.

$\frac{\overline{6}|\overline{6}}{}$ were missing when the patient was first seen. $\frac{4|4}{}$ were extracted. Only one piece of apparatus was used which was a saddle plate carrying a buccal bow with take-up loops. Fine wires were added to retract $\frac{3|3}{}$. $\frac{2|2}{}$ started to follow unassisted and finally the bow was tight-

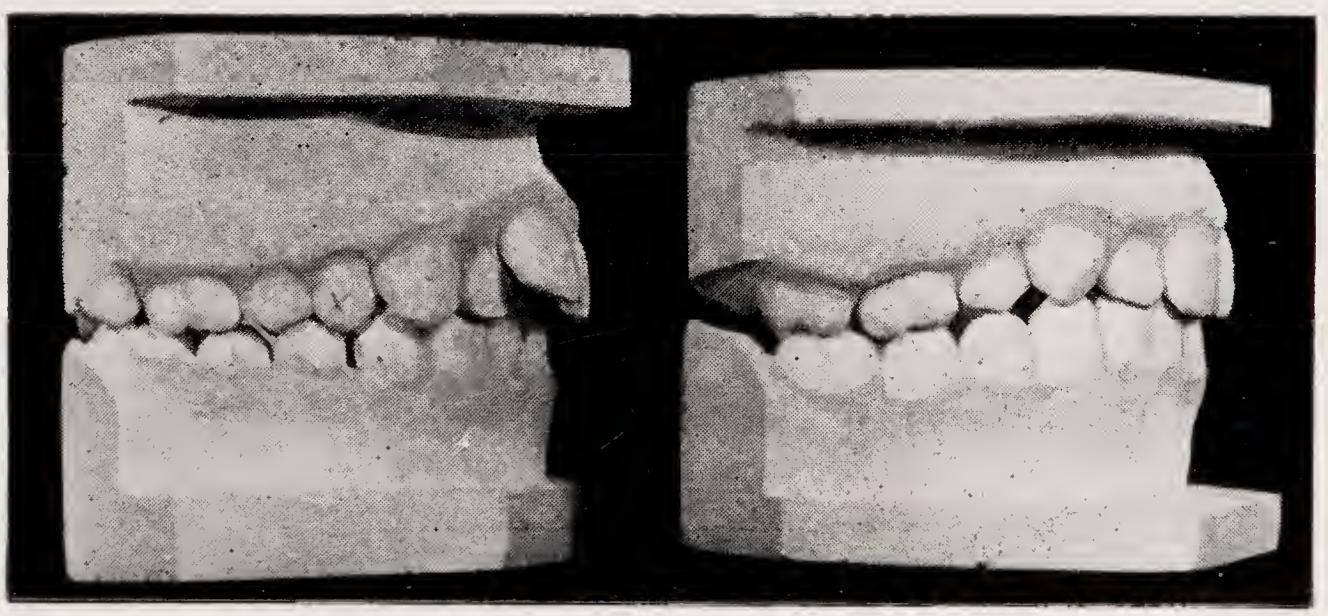


Fig. 6

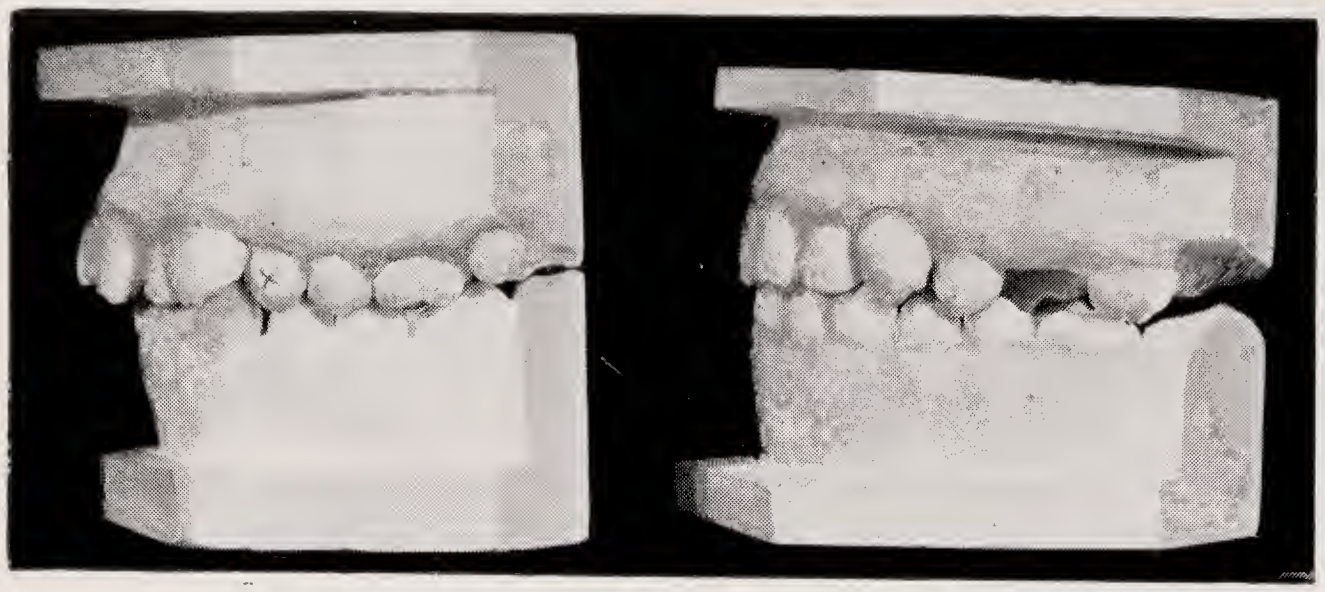


Fig. 7

Fig. 8

ened to complete the alignment.

I have not got a record of the amount of surgery time occupied but on the average it was less than one visit a month.

This right hand side shows an interesting feature of treating cases with removable appliances where the reciprocal action has brought $\underline{65}|$ well forward. All too often I find I am not able to get full advantage of all the space created by the removal of a tooth.

I have to thank Mrs. Small of the photographic department of Guy's Hospital for photographing the models and preparing the lantern slides.

* * * * *

DISCUSSION

The President said that the members were very grateful to Mr. Dimock for his communication.

Mr. Dimock had been facing a problem which, he thought, would increase as time went on, namely, the problem of what an orthodontist could do as a mimmum for a child when there was not time to undertake the case properly and only a minimum number of appliances could be used. That problem had arisen in the war, when orthodontists had been turning patients away from hospitals and wondering, as they did so, whether there was not something which they could do in a few minutes and which would benefit the patients. He felt sure, from the fact that Mr. Dimock had achieved what he set out to do, that the appliances must be very carefully made, particularly in the case of the mandibular movement, because it was not easy to make the lower appliance fit so well that an interior spring would be effective against lower incisor teeth.

Mr. W. Gardner said that he appreciated Mr. Dimock's technique and thought that he had done very well indeed.

He would like to know what was the diameter of the wire used in the little palatal finger springs.

Mr. J. R. Dimock, in replying to the President's remarks, said that he himself had not made the apparatus for any of the lower appliances. It had been made by a mechanic at the hospital.

The answer to Mr. Gardner's question was that the finger springs were made of 0.6 mm. wire.

* * * * *

AN APPARATUS FOR LATERAL RADIOGRAPHY

By J. D. HOOPER, L.D.S., (Eng).

It has been frequently stressed that accurate lateral radiographs would be of great use to the Orthodontist both in diagnosis and in the assessment of results. Unfortunately, up to now, no apparatus for obtaining such radiographs has been available in this country. The author was therefore stimulated to see whether an apparatus sufficiently accurate for clinical use could be constructed at a figure reasonable enough to be within the reach of the Orthodontist in private practice or-as in the author's case, in the School Dental Service.

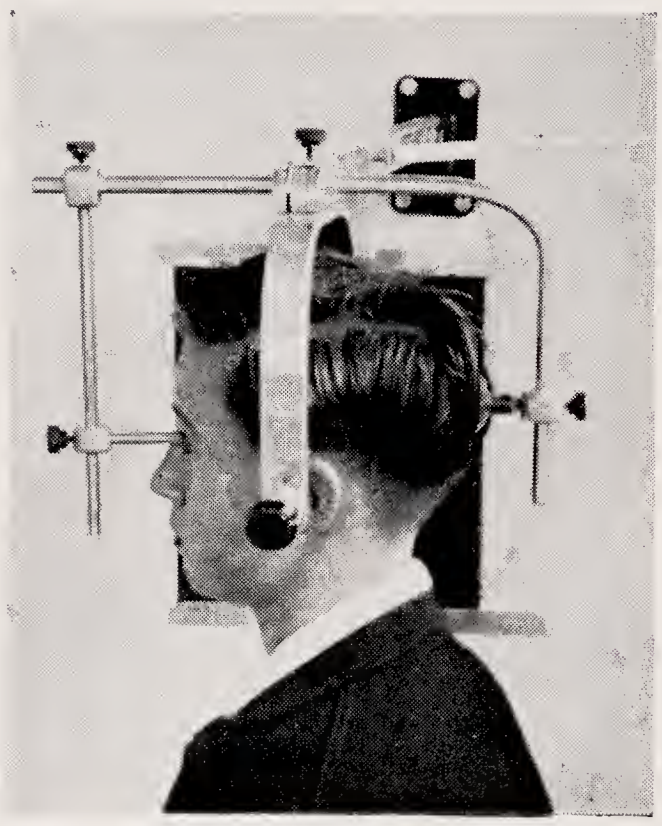
The apparatus to be described is not original in design, being a modification of that published in the *American Journal of Orthodontics* of April 1948 by Dr. M. Alden Weingart, D.D.S., to whom acknowledgement is hereby made. Since both the patient's head and the X-ray tube must bear a constant relation to the film the apparatus consists of two parts, viz :- the Head Positioner and the Tube Positioner.

The Head Positioner

This consists (*Fig.* 1) of a horizontal bar 'A.' supported in a phospher-bronze socket ' B,' and carrying the head bow ' C ' and the casette holder ' D.'

At the extremities of the Head Bow are threaded bushes into which are screwed the ear plugs ' E.'

The rod ' F ' passes through the Head Bow assembly and carries the nose pointer ' G ' and the Occipital Head Rest ' H.' All these parts are freely movable and can be locked in position with locking screws. There is also a Lateral Head Rest ' I,' located on the further arm of the Head Bow.



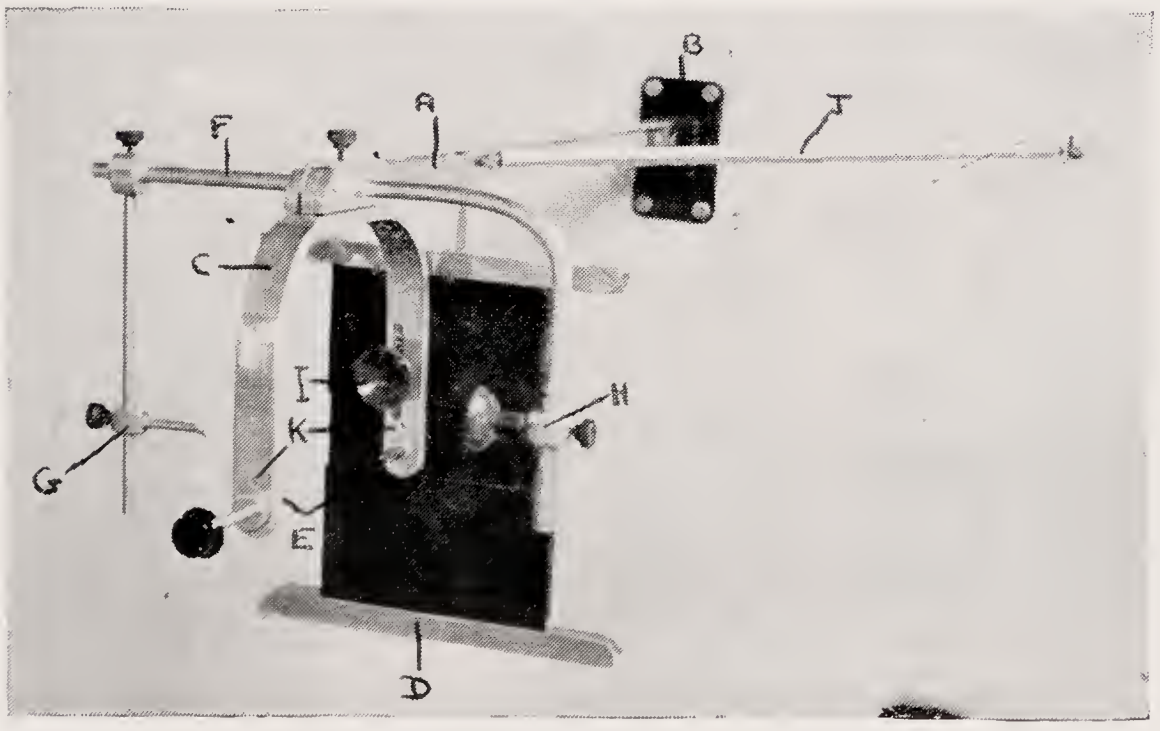


Fig. 1 (left)

Fig. 2 (above)

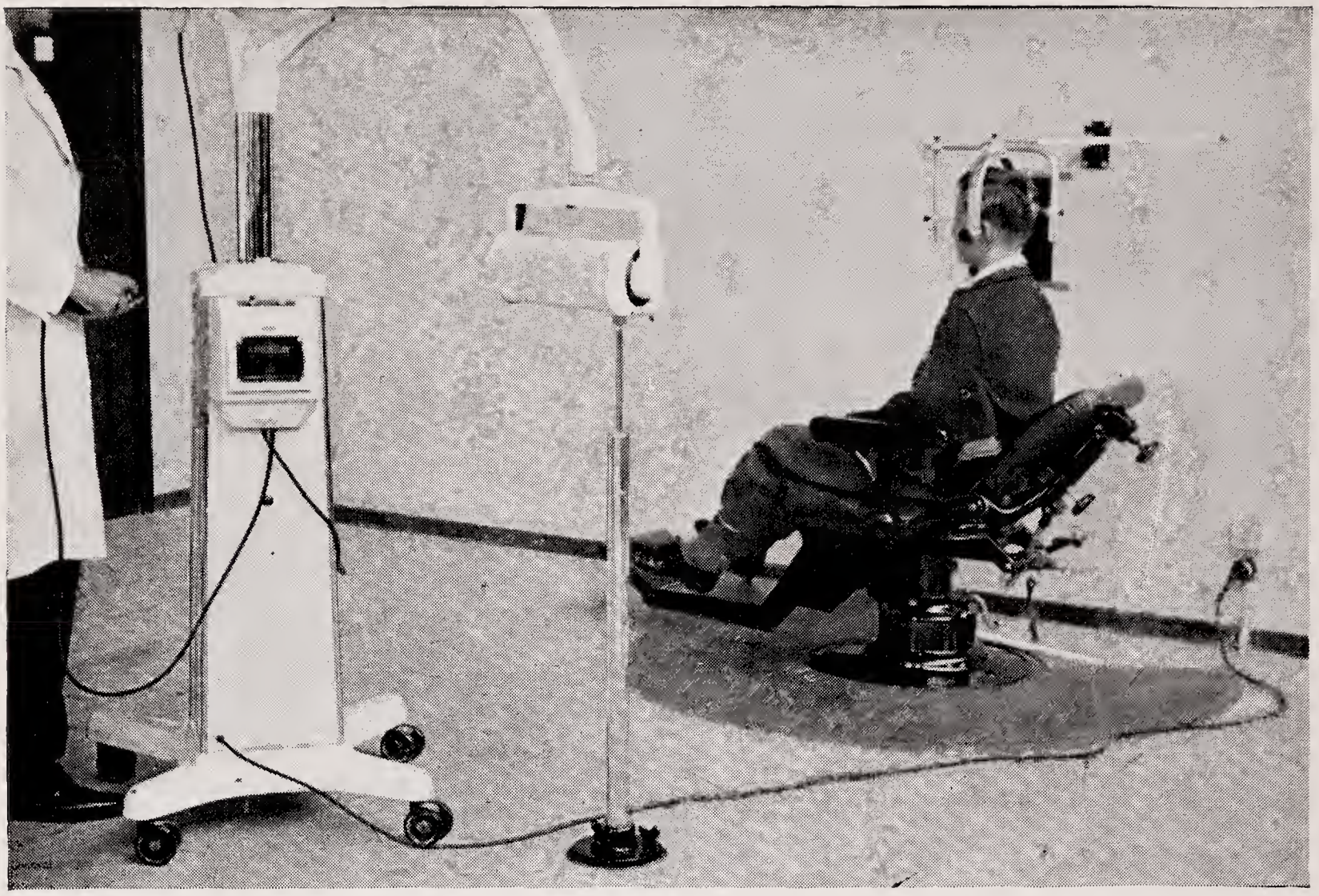


Fig. 3

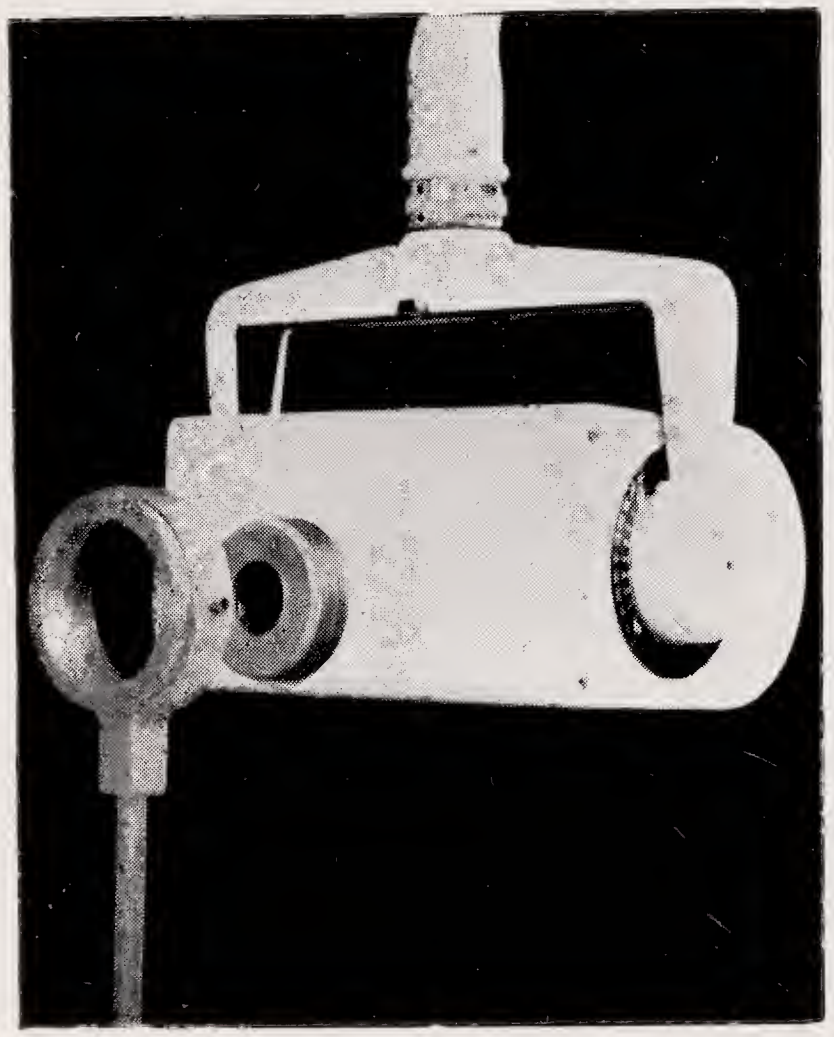


Fig. 4

The bar 'J' serves to eliminate any possibility of whip in the horizontal bar 'A' and is also capable of adjustment within small limits to ensure the passage of the central ray through the ear plugs.

Small holes 'K' have been drilled through the Head Bow and if the images of these holes superimpose on the film the adjustment is known to be correct. Also although the portion itself is obscured by the apparatus its position on the film can readily be fixed by reference to the image of these holes.

The patient is seated on the dental chair and the height adjusted until both ear plugs can be comfortably screwed into the external auditory meati (*Fig.* 2). The Lateral and Occipital Head Rests are then adjusted so that the patient can comfortably lean his head backwards and to the right thus eliminating the sensation that he is being suspended by his ears.

The placing of the nose pointer against the bridge of the nose is not essential but seems to assist in immobilising the patient during exposure.

Fig. 5

The Tube Positioner

This is fixed to the floor by means of removable thumb screws (*Fig.* 3). It consists of a cast metal base supporting a round section duralumin tube. Adjustable in this tube is a round section rod carrying a ring (*Fig.* 4). Free to rotate within this ring the end of which projects beyond the outer ring. The inner rotating ring is threaded to take the boss of the Watson Kingsway X-Ray Head from which the Cone has been removed. The X-ray head is therefore placed in opposition and the threads engaged. As the inner ring is rotated the X-ray head is drawn into position and finally locked there. The Anode film distance is 6 feet.

An exposure of ten seconds, with screens, has been found to give good results.

Fig. 5 is an example of a radiograph taken with the apparatus which is now in use at the Orthodontic Clinic, Teddington.

The apparatus was constructed almost entirely of standard size duralumin by Mr. Frederick Pay of Waverley Gardens, Twickenham. His engineering experience was invaluable in solving the many constructional problems that were met and he was responsible for the workmanlike appearance of the finished article.

Finally I should like to thank Mr. J. V. Bingay, M.B.E., L.D.S., the Area Dental Officer, for his frequent help, advice and encouragement.

Reference

Weingart, M. Alden. A Simplified Cephalometric Head Positioner. *Am. J. Orthodontics*, **34**:362: 1948.

* * * * *

DISCUSSION

Dr. Margolis said that the subject presented by Mr. Hooper was one of great interest to him, and he would like to compliment Mr. Hooper on his apparatus.

If the members would like him to be frank rather than merely courteous, he would say that he felt doubtful about the accuracy and stability of the apparatus. He was surprised that Mr. Hooper could get a superimposition with this sort of apparatus. It was an excellent device, however, and he was quite sure that it could have been stabilised if the parts had been made in a different manner.

In America, lateral radiography was used by him for diagnosis in every case. It was believed that, in order to diagnose a facial dental deformity, the first thing to do was to appraise the entire facial skeleton, and that could be done only by working at the face overall. It was also believed that it was necessary, secondly, to orient the dentition within the face and, thirdly, to look at the teeth themselves.

The point he wished to make was that it was his own feeling and, he thought, the feeling of many in America that more films and records of the kind in question should be made in the process of assaying malocclusion. He felt strongly that malocclusion could not be assayed simply by looking at a set of models. One did not know from the models whether one was dealing with a face which was well

developed and whether the dental apparatus was placed forward or back in the dental scaffolding. Therefore the diagnosis and the prognosis could not be made without such a record.

He did not wish to be critical of the apparatus shown by Mr. Hooper. He beleived that it was a great step in the right direction in this country and that it might only need a little screw here or there to fix it for use. The point was that Mr. Hooper was working in the direction which he believed to be the right direction for clinical use and not simply for theoretical or academic application.

The President asked Mr. Hooper whether the X-ray machine he used was an ordinary Watson-Kingsway and whether the photographs had been taken at 5 feet, which he believed was the usual distance.

Mr. J. D. Hooper, in reply, said that he entirely accepted Dr. Margolis's criticism, and he thought he had said that the apparatus was not intended to be used for statistical work but was meant to be used merely as a clinical aid.

The X-ray machine was an ordinary Watson-Kingsway one, and the photographs were taken at 6 feet, the exposure being 10 seconds with screens.

* * * * *

A CRANIOSTAT AND ITS USES

By P. D. PRIEST, L.D.S.

WHEN DESIGNING THIS CRANIOSTAT I endeavoured to keep its construction within the capabilities of the average handyman who has access to a lathe. The only assistance he is likely to need is from a jobbing foundry, which will cast the two non-ferrous discs, and from an engineering firm which will scribe the edge of one of these in degrees. Being an experimental model a number of the parts are unnecessarily complicated and experience has suggested easier forms of construction. It is, therefore, within the capabilities of every orthodontist to obtain, for a very moderate outlay, a machine which I believe will give results sufficiently accurate both for clinical use and for research. Any erorrs introduced by the craniostat are small compared with the error which inevitably results from clamping the head through the flesh and not direct on to bone.

This apparatus, *Fig.* 1., consists essentially of two ear-rods, accurately aligned on the central ray of the X-ray machine, a holder for the cassette and a device for positioning the X-ray tube. This is all that is required for lateral X-rays, but to give satisfactory and consistent results every part of the craniostat and X-ray

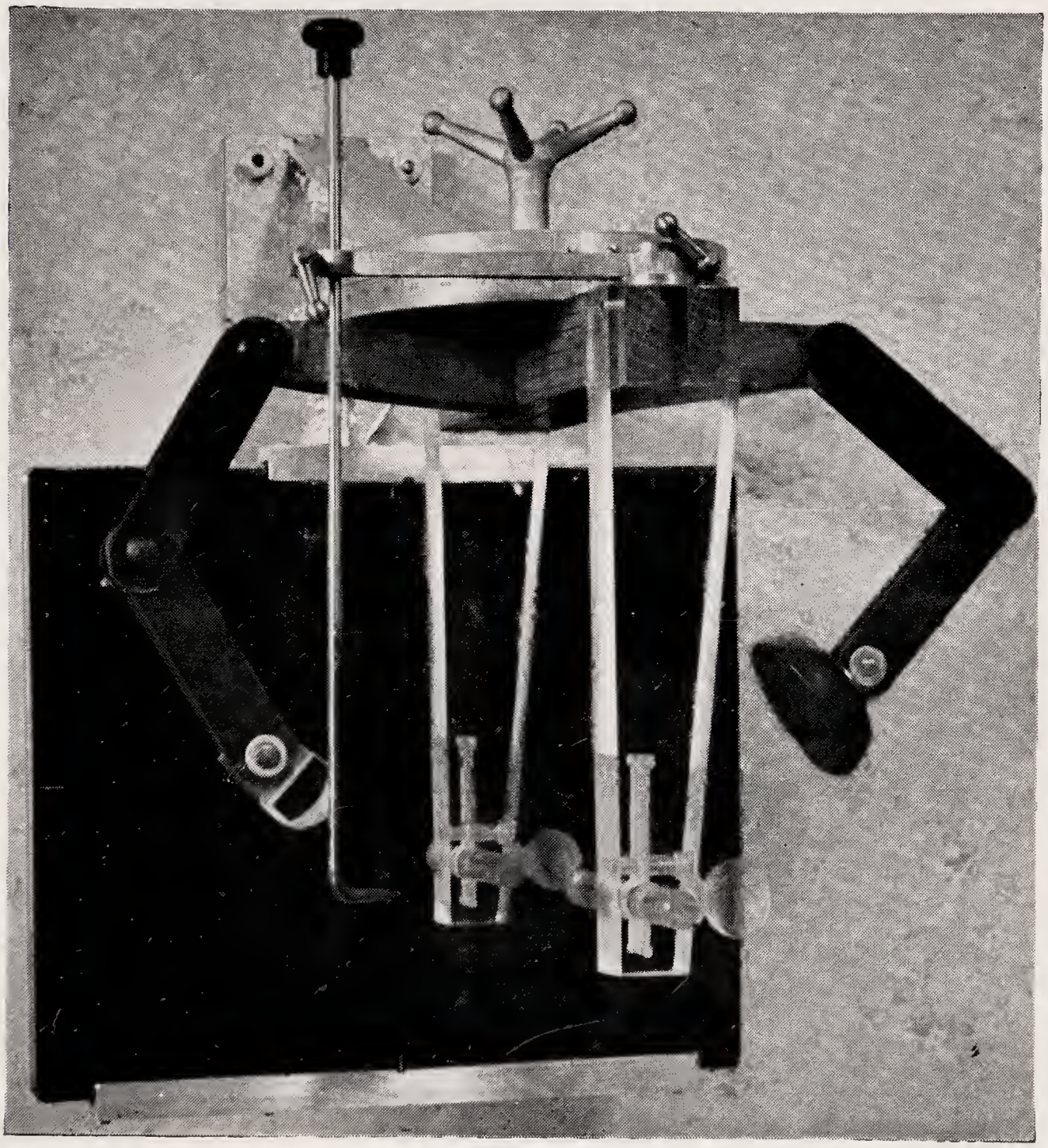


Fig 1

tube holder must be absolutely rigid. The patient sits on a stool which has been adjusted to the correct height, an ear-rod is introduced into each ear as far as is possible without discomfort, and the head is further clamped by the nose and head support. The patient is told to settle down on to the ear-rods and not to move or swallow. Using an ordinary Watson Dental X-Ray Machine, with an anode-patient distance of 5 feet, Ilford Red Seal films and superspeed intensifying screens, the usual exposure is 8 secs., for a lateral view *Fig.* 2.

When taking lateral views it is possible to obtain a profile of the soft tissues at the same time by enclosing in the casette under one of the intensifying screens, a film wrapped in its black paper. The black paper prevents the light emitted from the screen from affecting this film which is therefore, only subjected by the direct X-rays to a much smaller exposure. The soft tissues, which in the film of the bones are obliterated by over exposure, are now quite distinct. A composite picture can be made by taking tracings first

Fig. 3

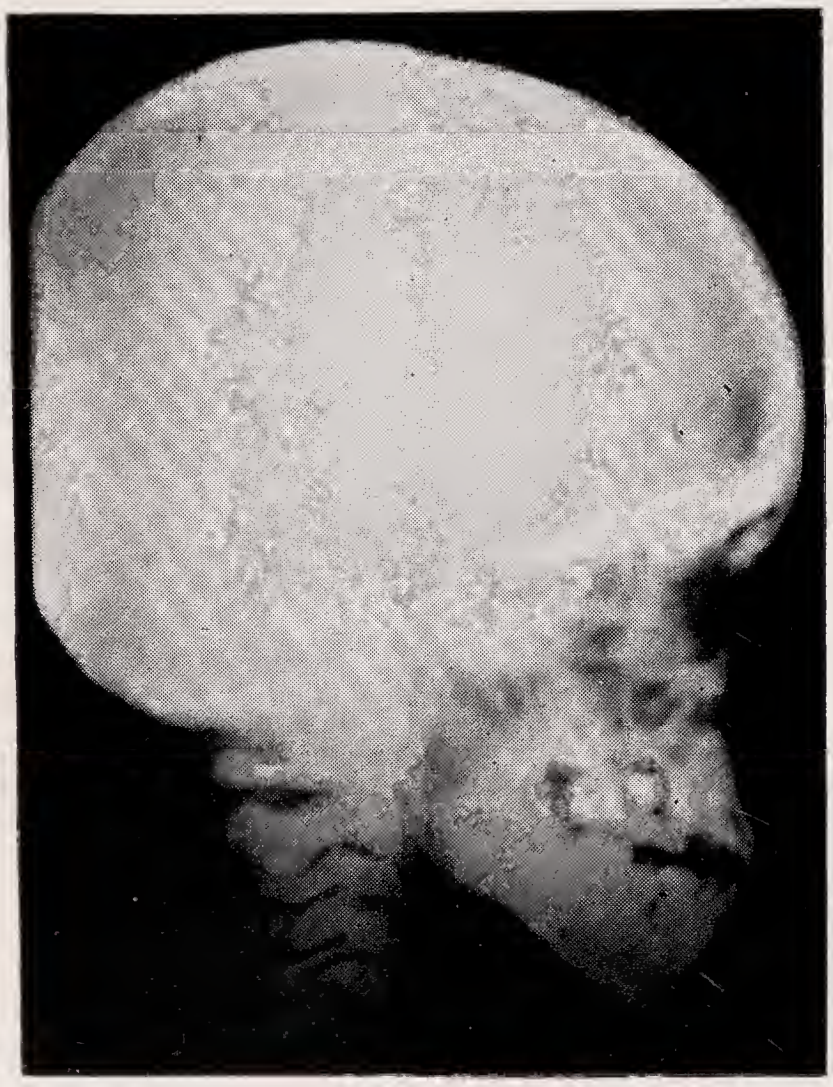


Fig. 2

from one and then from the other film, or the soft tissue profile can be traced onto the bony X-ray.

The X-rays produced by a craniostat are enlarged images as the rays which pass through the skull are divergent. The enlargement is in the ratio of the anode film distance to the anode mid-sagittal distance. If the distance between the X-ray machine and the casette is fixed, it only remains to get the anode mid-sagittal distance constant. This means centering the patient in the head holder by moving both ear-rods in or out an equal amount. If this is done accurate measurements can be made direct on the X-ray film, either by using a specially calibrated ruler or less easily by correcting the measurements on a graph or by arithmetic.

This craniostat has an eye pointer, the end of which is on the same horizontal plane as the upper surface of the end of the ear-rod—that is the surface which will, apart from the soft tissue lining of the external auditory meatus, be in con-

tact with the porion. With the ear-rods in position the head is rotated until the eye pointer is against the lower border of the left orbit—the orbitale. The head is now orientated on the Frankfort Plane and is held in this position by the nose and head support *Fig.* 3. This has no particular advantage for lateral radiogrpahs but is essential in the production of standardised anterior-posterior pictures. Although the head is always fixed by the ear-rods, but without an eye pointer one anterior-posterior view might be taken with the chin up and the next with the chin down.

In antero-posterior views the bones of the face, in which we are interested, are superimposed on the lower posterior part of the cranium, on the spinal column and on the tissues of the neck. The X-rays passing through this considerable thickness of tissue are scattered and a proportion deviate from their original path. This results in a loss of sharpness and particularly if this is done on a viewing box with variable illumination. This greyness can be almost entirely eliminated by the use of a fixed grid. Unfortunately its use requires a trebling of the exposure. A normally co-operative child can sit still for the usual exposure of 8 to 10 secs., but it is doubtful if he could do so for half a minute.

To take an antero-posterior view on this craniostat the head is rotated 90° as shown on the calibrated disc. By arranging two accurately located positions for the X-ray tube, one at the side of the patient for taking lateral views and one in the front for taking antero-posterior views, it is possible to dispense with the rotating head mechanism. This, however, limits the other uses of the craniostat. For example, with the craniostat I have described it is possible to take standardised pictures of the mandible. The object of this procedure is to take X-ray pictures by the ordinary half-plate technique but with the tube, the patient and the casette in known relationship. If the radiograph reveals a fracture, cyst or endosteal growth, etc., then further pictures can be taken after an interval and a direct comparison made by tracing or superimpoition. It is also possible to use this type of craniostat to take reliable X-rays of the condyles, in centric occlusion, normal resting position and the fully open position, without any possibliity of movement and with the patient's head and the X-ray tube at known angles.

The craniostat is a great help in keeping the head still whilst taking stereoscopic X-rays of the maxilla as demonstrated to this Society in 1948 by Messrs. D. P. Walther and Mr. F. L. Ingram. In this technique a film is held between the teeth and an upper occlusal exposure made from above one eye. The film is then changed, the tube is shifted laterally and the second exposure made from above the other eye. With the patient's head held by the craniostat the chance of movement is eliminated.

The craniostat can be used for holding the head whilst taking standardised photographs. For lateral photographs the head must be orientated on some fixed plane and the back must rest against some fixed point. The object of this is to prevent a picture taken " before treatment," with the head tilted down and the chin tucked in, being compared with an " after treatment," picture, with the chin up and the neck in a graceful curve.

Many people have helped in the construction of this apparatus and in preparing this paper. I should particularly like to mention Mr. F. Eskell who made the greater part of the craniostat.

Reference

Margolis, H. I. *A.J.O. & O. Ling.* 26 : 725. 1940.
(*Standardised X-ray Cephalographics*)

* * * * *

LIP EXERCISES

By H. E. WILSON, L.D.S.

I HAVE SELECTED the above title for my paper although most of it deals, not with lip exercises, but with the anatomy and physiology of the musculature of the lips. As clinicans, orthodontists are, sometimes, more concerned with appliances and their effects than with the detailed anatomy and physiology of the oral structures. Nevertheless, this knowledge is the basis upon which we base most of our clinical procedure. The title was selected, therefore, not so much to name the subject, as to draw the attention to it's clinical application.

Opinion regarding the lips, their effect on the dental arches, and the efficaciousness of lip exercises, vary considerably. Some hold the view that the lips have no effect whatever on the dental structures. On the other hand, Mr. Hovell, with his ingenious model, demonstrated before this Society that an Angle's Class II Div. 1, where the apical base relationship was normal, was due to a faulty lip posture. I have often heard it said that muscle patterns cannot be altered but speech therapists use lip exercises extensively, and they claim, successfully, to develop and re-educate the oral musculature. In the short time allotted to me I will endeavour to produce some evidence to help settle some of these points.

The anatomy of the oral muscles and the muscles of expression or " mimetic " muscles, is well known to you all. They include the Levator labii superioris alaeque nasi, Levator labii superiories, Zygmaticus major, Levator anguli oris, Zygomaticus minor, Mentalis, Depressor anguli oris, Depressor labii inferioris, Buccinator, Orbicularis oris, Risorius and the Platysma.

To us the most important muscle, if there is one muscle more important than the others in the group, is the obicularis oris. It is also the most complex. In it no true orbicular or circular fibres are found. According to Dr. Lightoller it consists of eight parts ; right and left upper, right and left lower, each of which is divided into *pars peripheralis* and *pars marginalis*.(1) (*Fig.* 1).

Fig. 1

(This illustration gives you some idea of the anatomy of the *orbicularis oris* and the relationship of its two parts. It also shows the Mentalis and the Depressor *labii inferioris*).

At the angle of the mouth there is a " definite rounded eminence with a well marked vallum superiorly and laterally " and " is due to a muscular modiolus lying immediately beneath." Its importance is due to the fact " that it is the meeting-place of so many of the muscles surrounding or running towards the rima oris on either side " and " whose fibres intermingle with the mass." (2) The modiolus is taken to be the area of insertion of all the muscles entering it except the M. orbicularis oris for which it forms an area of origin.

As in limb movements every contraction of the " prime movers is accompanied by a contraction of the group of fixation muscles. When the lips are moved by contraction of the orbicularis oris the modiolus is fixed in a position by the remaining muscles in the group. In the action of closing the lips the dominant muscle or prime mover is the orbicularis oris pars peripheralis and fixation muscles are the Zygomaticus major, buccinator and the depressor anguli oris. If during this movement this muscle is palpated a definite increase in tension can be felt. As these fixation muscles come into play they draw the molodius slightly backwards. Dr. Lightoller states that " By this posterior

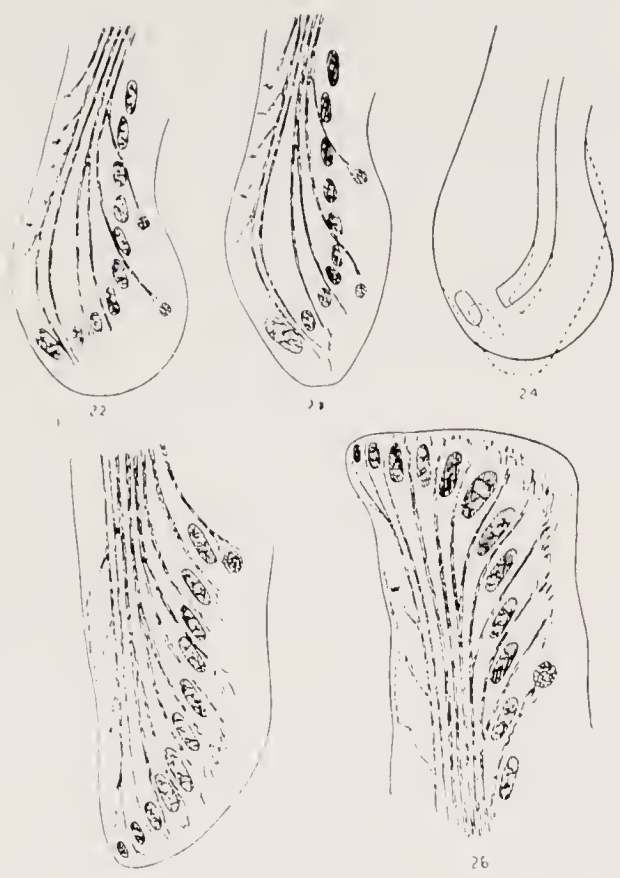


Fig. 2

fixation of the modiolus, when the lips act, they are closely pressed against the teeth all the time." (3) This is a statement by a man who has made a detailed study of the structure and action of the lip muscles. It cannot be reconciled with the statement that " cheeks and lips lie like a curtain and have no effect on the dental structures."(4)

At rest the lips are curved from canine to canine with the convexity facing forwards. When the orbicularis oris contracts it tends to take up a position which is the shortest distance between these two points and in doing so exerts a pressure on the anterior teeth (*Fig.* 2). (This slide shows a section of an upper lip of a female, at rest, and during the formation of a *labial cord*, and composite diagram of the upper lip when at rest and when forming a *labial cord*. *Labial cords* means the formation of the lips into musical stops similar in function to the vocal cords).

If by some faulty posture of the lips this physiological force is missing from the anterior teeth the balance of pressure is disturbed and the teeth move away from the greater to the lesser pressure.

If the lips are abnormal, morphologically or posturally, can any change take place to allow them to take on their normal function ? The physiologists say, that, with exercise, three changes can take place in muscle tissues.

1. An increase in the size of the individual fibres.
2. An increase in the number of fibres.
3. A neuro-muscular change, i.e. re-education.

This applies to skeletal muscle including M. orbicularis oris. Lips that are termed " atonic " can, therefore, have their " tonicity " increased. *Tone* can briefly be described as a balance between the length and stretch of muscle and depends on *a*) nerve supply and *b*) stretch reflex. It depends on a repetitive stimulation affecting the individual fibres of the muscle and, of course, if there is no stretch there is no " tone " in the muscle.

The most important of these changes is not the increase in size or number of the fibres but the neuro-muscular change or, what I think is a better term, re-education. That means that the C.N.S. is educated to send impulses to the group of muscles to perform a certain movement and to synchronise the contraction of the individual members of the group to perform that particular movement to the best advantage and with the least expense of energy. " It is movements and not individual muscles which are represented in the cerebral cortex." (5) " It will now be apparent that the efficient performance of any movement depends on the proper co-ordination of prime movers, antagonists and fixation and synergic muscles, and this co-ordination is ensured by the manifold connections which exist within the central nervous systems." (6) Similarly, posture is maintained by this co-ordination which is likewise maintained by the central nervous system.

If all this is true, and I have no doubt that it is, then lip exercises can be a useful form of therapy to the orthodontist. It can in younger children be a possible means of preventing certain dental malocclusions, or it may ensure the stability of a corrected malocclusion if the lip posture was one of the causative factors.

Lip exercises are used, therefore, to develop the lips, particularly the upper lip,

and to allow them to assume their normal posture and their normal physiological function. The exercises take various forms and generally speaking the type depends on the age of the patient. For younger children, exercises in the form of games, are for obvious reasons, generally prescribed. They include blowing games, playing " fishes " etc. and contests between two or more children in holding objects between the lips. In older children, drawing their attention to the faulty posture and an appeal to their vanity is sometimes sufficient. Favourites of mine are *biting the upper lip* and *whistling*, which if it isn't always musical, is certainly, at times, amusing.

The various forms of oral screen are invaluable and in this group I include the Monobloc or Andresen appliance.

When advising lip exercises I very carefully explain the reason for doing so. Success would never be achieved if the instructions were casual. The patient, or with young children, the parent, must realise the importance of the instructions. They must be convinced that their efforts are going to make all the difference between success and failure. When they are convinced, success is nearly always achieved.

Summary

1. Faulty lip posture can be a causative factor in dental malocclusions.

2. With exercise, skeletal muscle " develops " :

   a. by an increase in the size of the individual fibres.

   b. by an increase in the number of fibres.

   c. by re-education.

3. Lips can be " developed " by lip exercises.

4. Lip exercises are an efficient form of therapy for certain dental malocclusions by correcting faulty posture and restoring proper physiological function.

Finally, I am indebted to Dr. L. Bernstein, of the London Hospital Medical College for his assistance.

References

(1) G. H. S. Ligh oller. " Facial Muscles," *The Journal of Anatomy.* **6o.** 22.

(2) *Ibid.* p.23.

(3) *Ibid.* p.54.

(4) Prof. Sheldon Friel. " Migration of Teeth,' *The Dental Record.* **69.** 3.

(5) *Gray's Anatomy.* 28th edition. p.521.

(6) *Ibid.* p.522.

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DISCUSSION

The President said that the members were very much indebted to Mr. Wilson. It was time that some of them, including himself, rubbed up their anatomy and physiology a little. He was glad that Mr. Wilson shared the views held generally by orthodontists on the importance of functional treatment and exercises in orthodontics.

Mr. W. J. Tulley said that he would like to thank Mr. Wilson for his communication and very interesting slides.

The buccinator muscle formed the bulk of the musculature of the lip, and the actual contraction of the lip exercised considerable pressure on the teeth in the normal closed position.

Mr. J. H. Hovell said he thought that Mr. Wilson's communication was a very important one. He felt very strongly that when any case was presented to an orthodontist for diagnosis the teeth in a linguo-buccal or linguo-labial position were in a position of balance between the musculature of the lips, the musculature of the cheeks and the musculature of the tongue. If the case was treated without the musculature being altered in any way, he thought it was bound to relapse, so the orthodontist's diagnosis and prognosis must be based on his experience of whether he could change the musculature. If it was a type of musculature which could be altered, he thought that success could be achieved, but, it if was not, he

thought that any labial or lingual movement of teeth was bound to relapse, a very good example being the type of closed bite which was due to a hypertonic labial musculature with retroclination of the upper and lower incisors and consequent over-eruption of the lower incisors.

Mr. Ballard said he thought that the most important point in Mr. Wilson's communication was that muscle pattern was truly a pattern which arose in the central nervous system. His experience of lip exercises was that they had to be of such a nature that the pattern was changed through the central nervous system. The lip exercises advocated in the past, when a little thing was worn between the lips for, say, twenty minutes twice a day, did not impress, he thought, a new pattern on the central nervous system. The new pattern could be produced in one of two ways. It could be done consciously, as, for instance, by a person who wished to change the lip pattern, such as a young lady of 14 or 15 who had been treated by an orthodontist and wished to keep her lips together. The same conscious change occurred in people who, wanting to claim compensation maintained a limp after they had been knocked down by a car. In the other case the change was produced subconsciously, as, for instance, by children who sucked an appliance and thus brought their lips together and changed the pattern of their lips. They lifted the tongue up against the soft palate and changed the muscle pattern at the back of the mouth, so that if they were mouth breathers they became nasal breathers as a result of the lips and soft palate functioning properly.

Mr. H. E. Wilson, in reply, said he thought that both Mr. Hovell and Mr. Ballard agreed with him about the buccinator. On studying the anatomy of the subject, he had found that it was generally held by anatomists that the buccinator was inserted into the modiolus, which was a rounded mass of muscle just inside the cheek and was sometimes quite noticeable in people with very little subcutaneous fat.

The President, in proposing a vote of thanks to Mrs. Davies, Mr. Dimock, Mr. Hooper, Mr. Priest and Mr. Wilson for their communications, said he thought the meeting had been a very successful one and that a meeting of a similar type might well be held at some time in the future. He was sure the Secretary would like tohear from any members who had communications which they would like to put before the Society.

The vote of thanks was accorded with applause, and the meeting then terminated.

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THE THIRD NORTHCROFT MEMORIAL LECTURE

THE FIXATION AND STABILITY OF THE TEETH IN THE JAWS WITH RELATION TO THEIR MORPHOLOGY

By PROFESSOR R. SELMER-OLSEN.

When I received an invitation from the B.S.S.O. to give the Northcroft Memorial Lecture I thought it would be of interest to bring forward some observations I have made during the past 16 years whilst studying about 500 Lapp skulls. My main work is not a suitable subject for a lecture but apart from this I have been especially interested in the adaptation of root form to changing function when comparing the teeth of Sinanthropus Pekinensis and the Lapps. And it has struck me that these changes must be concerned with the stability and fixation of the roots of the teeth in the bone.

The Lapps present an advantageous opening to a discussion of these problems. Lapps are small in stature ; they are brachycephalic and the lower part of their face is exceptionally small with an orthognathic profile. Their mandibles especially are small ; indeed, they are often so delicately built that the jaw-bone of an adult may correspond to that of a 4 to 5 year old child in the Norse Group of people. They are, therefore, extremely tiny-built human beings. (*Figs.* 1, 2 & 3) At the same time, however, they are what we call " strong of sinew." They use their teeth in a way which, to us, would be almost unbelievable. Not only does their food consist of hard dried reindeer meat, but, as with many of those who live close to nature, their teeth are tools for the preparation of several necessities of life, such as the turning of hides into clothing and other requisites, of sinews into thread, etc. In other words, great demands are made on their chewing implements.

It is of interest in connection with our subject, to dwell for a moment on his descent, since the Lapp, in the formation of his teeth as well as in his craneology and osteology differs in various ways from all other races in existence today. Philogenists and Anthropologists have, in the course of time, thought they could prove relationship first with one and then with another race. The common belief is that the Lapp belongs to the mongoloid group. Professor Hooton and Professor Coon, however, hold to the conclusions which the Norwegian anthropologist Professor Schreiner and his wife Dr. Schreiner reached after long and detailed studies : namely, that the Lapp is the remnant of a branch of the human tree from the time before the two groups, the mongoloids and the so-called white race, manifested themselves, and his line of development took a different direction from that of these two groups. This does not mean we are confronted with a pure race. Some Lapps, like all nomads, have mixed with other blood during their wanderings, especially in the later centuries, when they settled permanently in Northern Scandinavia and some in Northern Russia.

The conclusions reached by Professor and Dr. Schreiner are verified by dental

Fig. 1. Lapp from Kautskeim
(Photo by courtesy of Professor Schreiner)

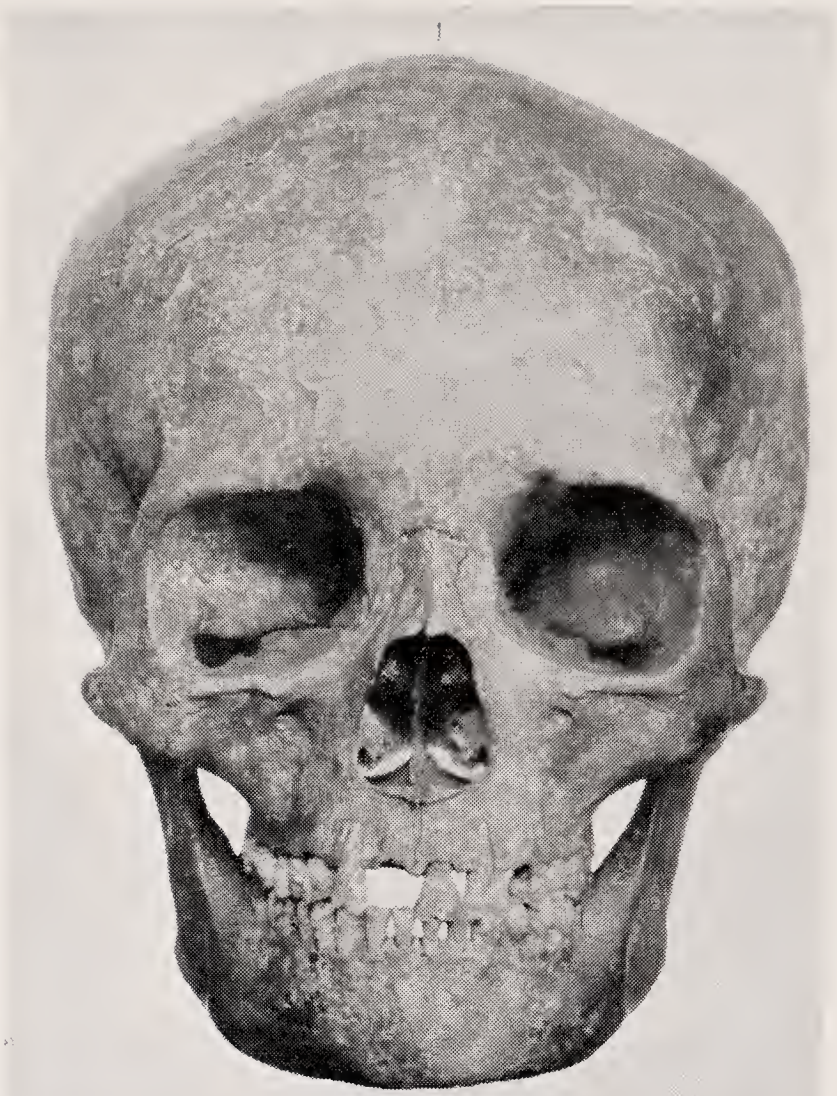


Fig. 2

Fig. 3

research. Different traits in the characteristics of the teeth place the Lapp in a class of his own as compared with all the other races with whom it has been possible to compare him. This can be illustrated by a few diagrams. Too much stress must not be laid on details. The statistical accuracy of the differences is not always adequate because of the variation, which is always great. When the same tendency is visible from tooth to tooth and the same holds good both in the one race and in the other, then the certainty is increased and the picture of the whole becomes visible. The Lapp has exceptionally small crowns to his teeth ; only one or two other races have teeth with crowns of about equal size (*Figs.* 4, 5 *and* 6). If we make a comparison with a fossil like Sinanthropus Pekinensis, according to Professor Weidenreich's far-reaching and thorough investigations, we find that the nodules of the molar crowns of the Lapps are only about two-thirds of it. It is like David and Goliath.

With this as a background, the next illustration becomes quite astonishing, in that the length of the molar roots, and especially the 2nd molars, is exceedingly great in the Lapp (*Fig.* 7). These are the absolute measurements. If the values are related to the size of the crown of the tooth, the difference becomes striking. Even the impressive Sinanthropus teeth have roots the length of which lies inside the limits of variation of the small Lapp teeth. What will however be especially noticeable in our comparisons with types like the

Australian aborigines and Sinanthropus, is that this refers to the molar roots and not to the roots of the incisors and canines. In the Lapp these are often very short. These teeth which have accordingly relatively short roots, have at the same time, the greatest height of their crowns from the neck to the incisal edge. This is especially so in the first incisor of the upper jaw.

I am sure, ladies and gentlemen, that you will agree with me that these graphs are well worth reflecting-upon, they must contain the workings of certain natural laws. It cannot be a mere philogenic coincidence which has given the roots this size and shape so different from other races.

During my metrical studies it occurred to me that the division of the roots of the teeth might also be worthy of consideration. This is a subject of its own and has not been treated in detail. Research does, however, point to things of interest.

Fig. 8 shows, with one exception, that the male has, as far as both frequency and degree are concerned, a more distinct root division than the female, that is the root division seems to be related to a greater or smaller muscular power. The one exception was the 1st molar in the lower jaw. Apparently a differentiation must be made between a bucco-lingual and a mesio-distal root system in further investigations.

Fig. 9 shows frequency and degree in the local groups. In some districts the Lapp is mixed with Norwegian blood and in others, with Finnish or Russian. Long isolation may also have a purifying effect after possible mutations. It appears, therefore, from these investigations that we are clearly confronted by a racial characteristic.

By correlating the root length of the maxillary premolars with their degree of root division, it was found that there is what statisticians call a negative connection. The same was discovered in respect of the canine teeth and premolars of the lower jaw. In those cases where the tooth on the one side had a split root and that of the other had not, the split one was shorter (*Fig.* 10).

The third characteristic to which I wish to draw attention is the stoutness of the roots. In the material and especially in the local group which has the greatest average length of molar roots, the Neiden group, we find slender teeth with pointed apices. No measurements or estimates have been made and at the moment I do not know how these could be made in an accurate way. Clinical observations and comparative studies point to the fact that even here we find a negative relationship between the length and the stoutness of the root. The stoutness of the root as a racial characteristic is, perhaps, most visible by comparison with an extreme opposite like Sinanthropus (*Fig.* 11).

In other words we are confronted by three characteristics which seem to have a certain connection with each other and which, to a greater or lesser extent, vary with the races. Postulating a connection between function and morphology— whether we lean towards the one or the other theory of evolution—we will now procede to give these characteristics our attention and regard them in relation to those problems which it seems they should solve.

Those questions which we quite naturally ask are ; what are the functions of the tooth root, and how do other structures help it, for example the peridental membrane and the surrounding bone.

The functions of the root can be expressed in these two points :—

1. To give the crown stability.
2. To ensure the fixation of the tooth.

What difference is there, then, between these two functions of stabilisation and of fixation ? By stability I mean the security of the tooth in the alveolus during intermittent chewing ; and by fixation I mean the ability to withstand lasting strain. I believe these to be two completely separate things although the two functions cannot be distinctly differentiated. These are things with which we, in the capacity of orthodontists, ought to be acquainted.

But how can we speak at all about a greater or lesser stability ? If the tooth was fixed in the alveolus like a nail in the wall, then stability would be complete. Such a secure fit would, among other

Lapps compared to various white races.

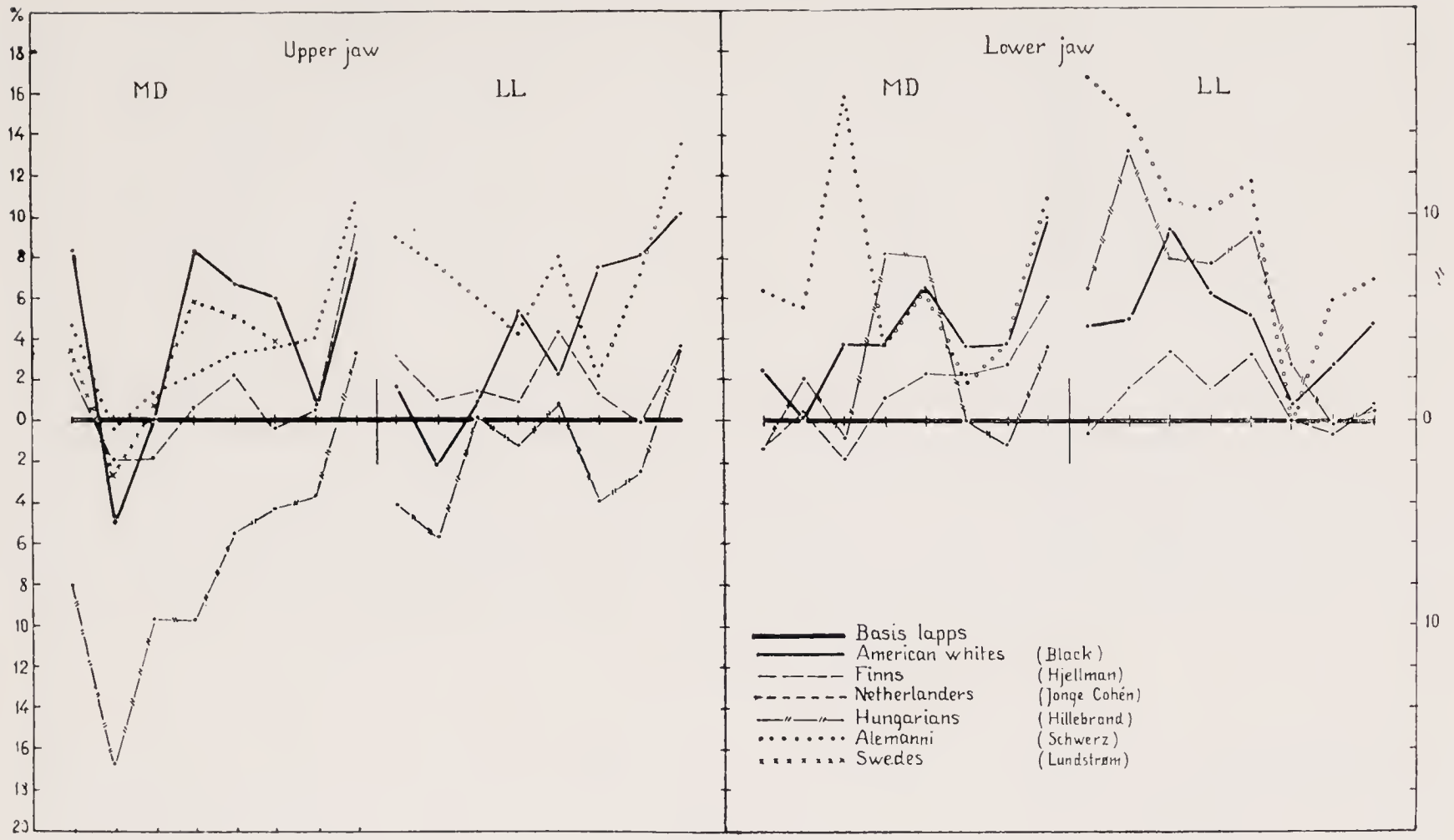


Fig. 4

Lapps compared to various mongoloid races

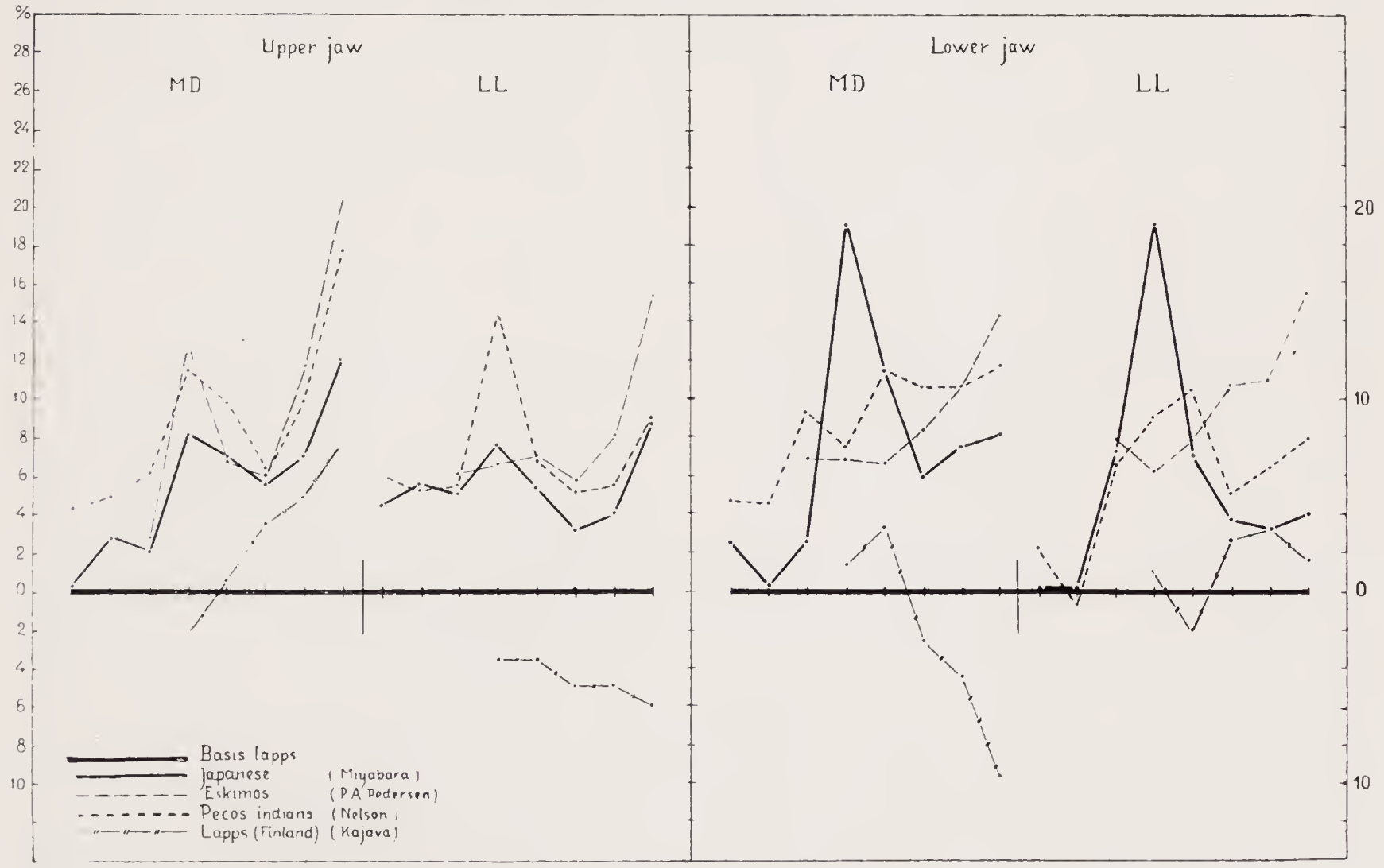


Fig. 5

Lapps compared to various negroid races.

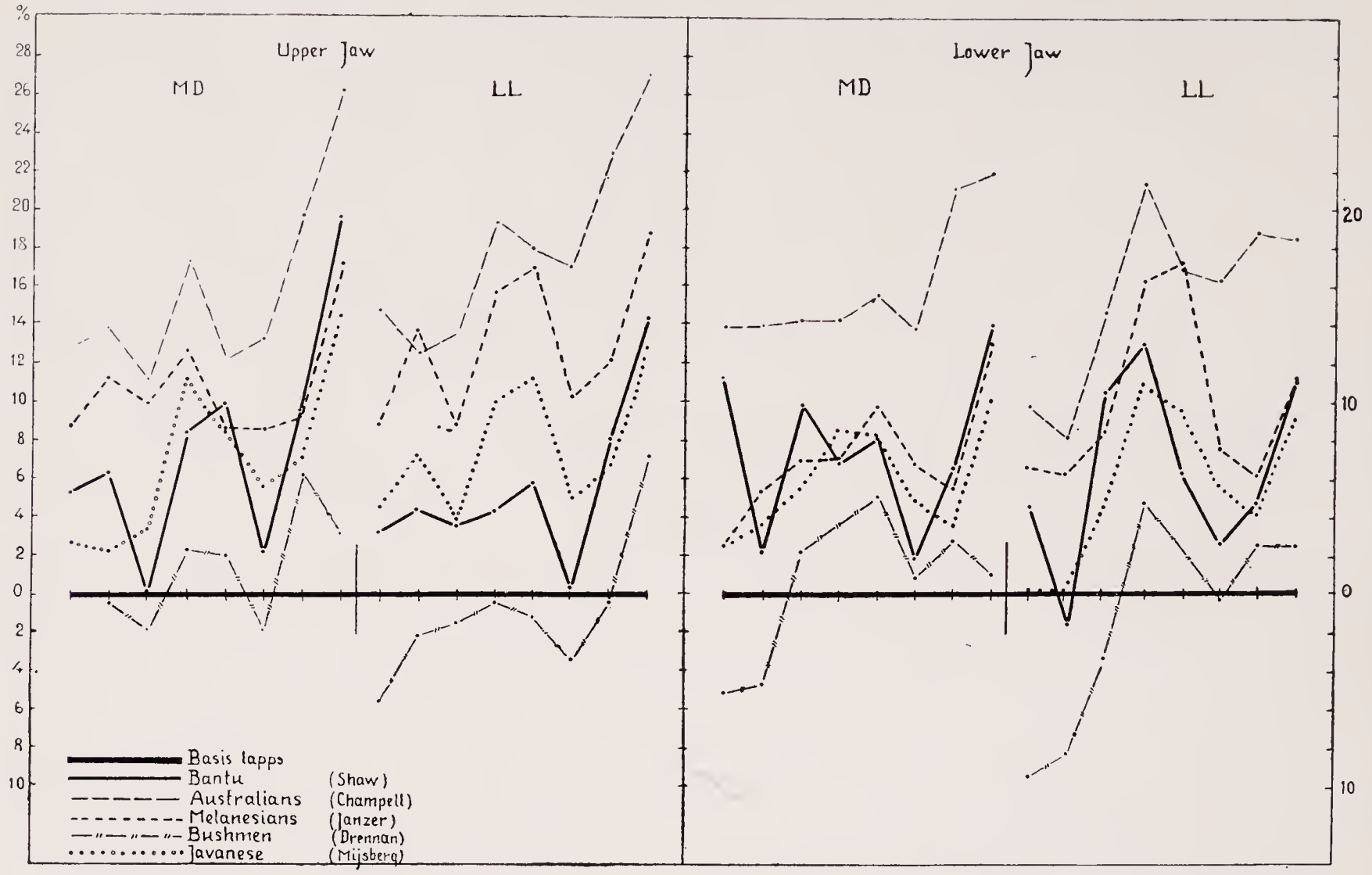


Fig. 6

Lapps compared to various other races.

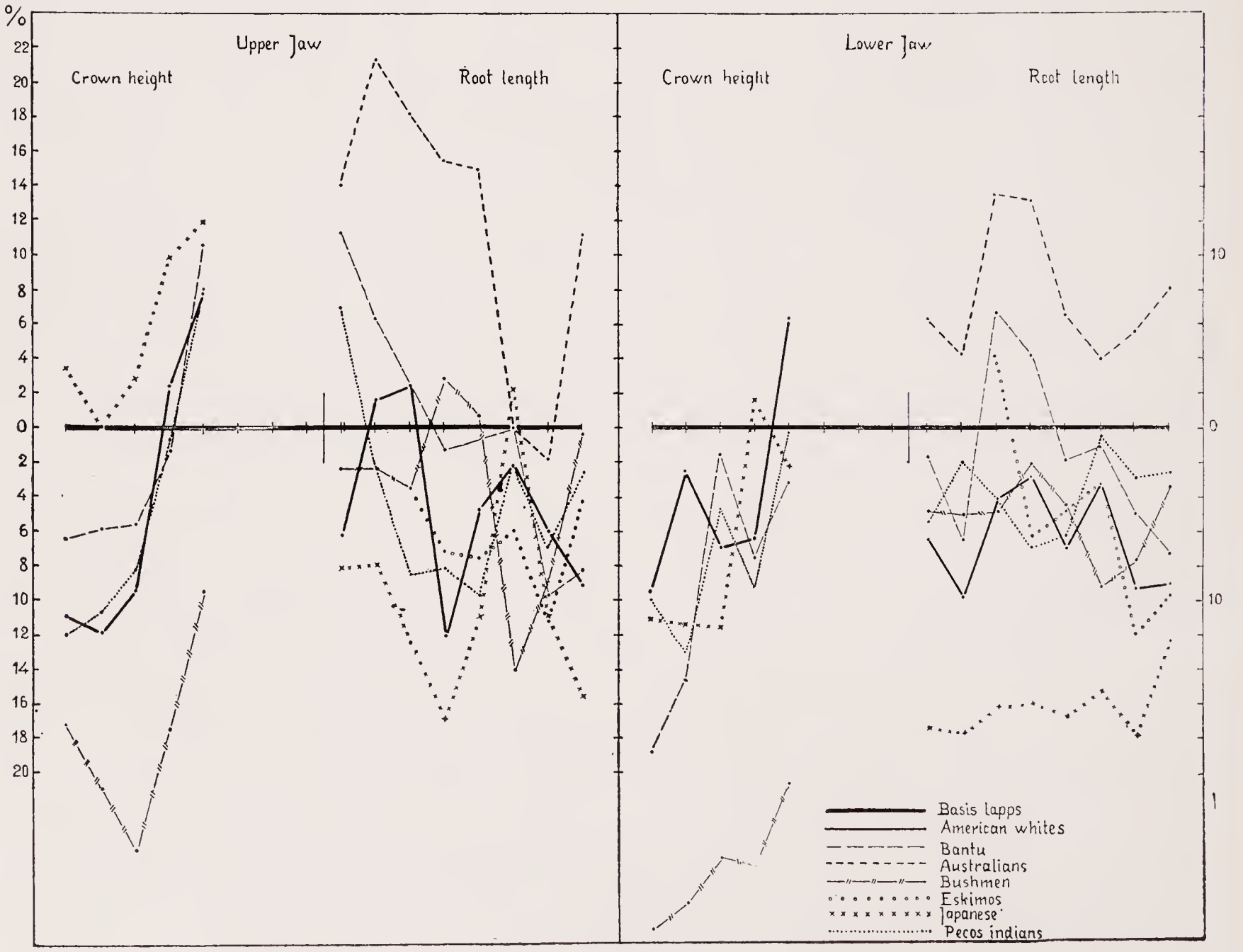


Fig. 7

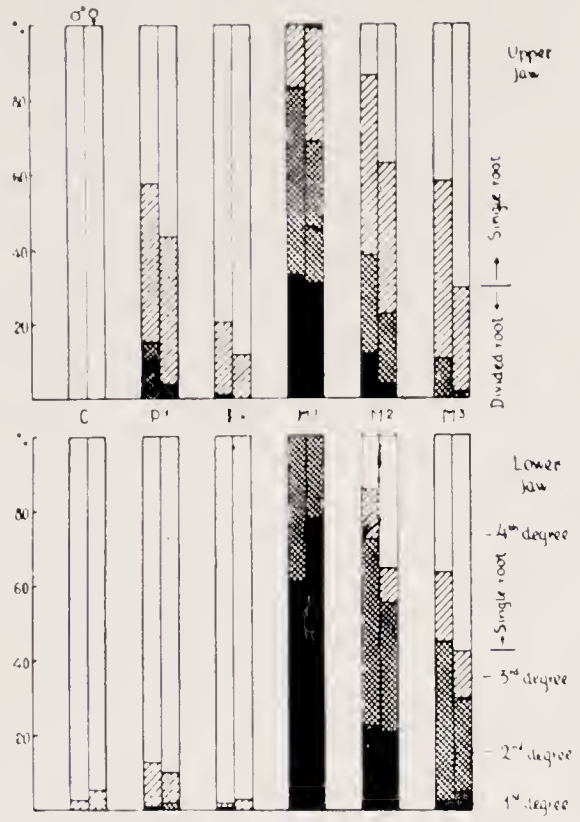


Fig. 8

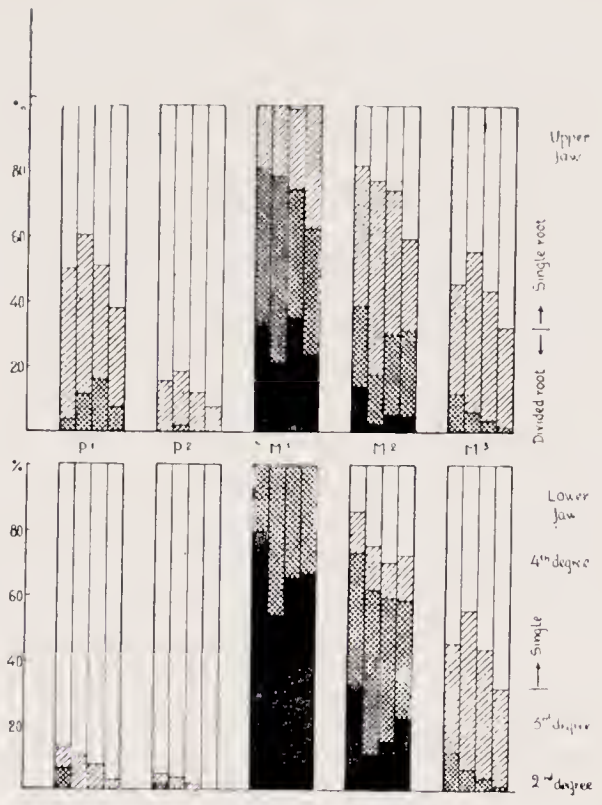


Fig. 9

things, make considerable demands on the ability of the root to withstand fracture. I will illustrate this later. Whatever nature's reason for inserting a periodontal membrane may be, it is certain that it gives the root freedom of movement in the alveolus and makes possible an elastic absorption of the strain and a dampening of the impact. We may compare it to a railway buffer. Our first point—stability—accordingly becomes a somewhat complicated problem. On the one hand, the tooth must be fixed as securely as possible in the jaw bone in order for the chewing process to be effective, and on the other hand, the root and the tooth must be protected against trauma by means of a certain freedom of movement which can have a buffer-like effect. Too much movement will, in addition to impairing function, cause inflammation of the periodontal membrane to which Noyes drew attention.

When a tooth incurs a functional strain, that is, a strain of relatively short duration though possibly of considerable power, two things of primary interest to our problem occur in the peridental membranc. Firstly, an uneven fluid pressure is created and sccondly, the soft tissue is disturbed from its position of rest.

These matters havc bcen discussed by the following histologists: Weski, Noyes, Gottlieb, Lang, Haupl, Orban, Kronfeld, and Reichborn-Kjennerud.

In 1928, Klein presented a comprehensive invcstigation of the thickness of the periodontal membrane in the different areas of the root. Coolidge undertook similar investigations later, his findings being somewhat different from Klein's. Kellner has compared the thickness of the membrane in the case of functioning and impacted teeth. In 1928, M. A. Schwarz published an article on the movement of the root with various kinds of loads. As a consequence thereof, Synge, thc mathcmatician, carried out comprehensivc calculations which gave rise to an article by Gabel.

While having in mind the results which histologists and mathematicians have arrived at, we will attempt to study the various questions from another point of view to see what odontographical investigations on the morphology of the teeth can contribute.

Agreement prevails as to the periodontal fibres being unelastic. Their coursc is wave-shaped. They are interwoven and the bunches of them go in different directions. The fibres also encircle vessels, nerves and other tissue.

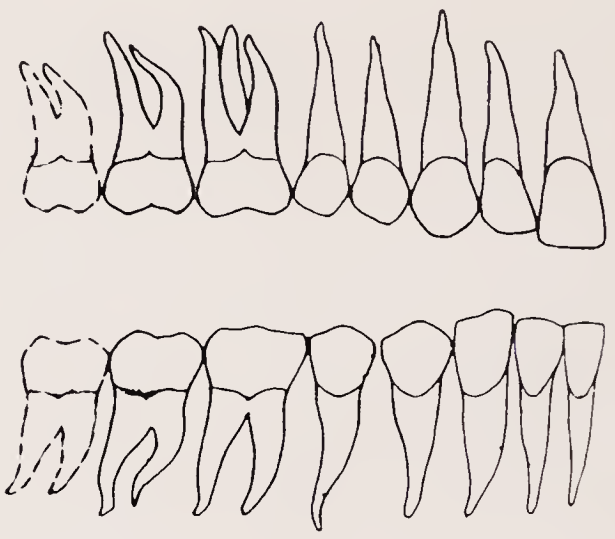
If the tooth is movcd, somc fibres are stretched, that is to say their waves arc straightened out, and others are compressed. By being disturbed in this manner from their position of rest, by some means a pressure is exerted against the neighbouring fibres, intercellular substance,

blood vessel or whatever it may be, with which the fibres are in contact in either direction. To put it simply, we may say that a body which is round in its position of rest is pressed flat, or one which is oval is perhaps made round. It is therefore sluggishness in the changing shape of the individual elements of the membrane which gives the fibres an elastic character. Each fibre must have such an elastic effect if the link joining its insertions to the root and to the bone is to be movable. This does not only apply to the stretching and compressing sides, which are generally noted, but must refer to *all* fibres, Inasmuch as the point of fixture is moved, so the soft tissue must be brought out of its position of rest. In this way, the strain on the root is evenly distributed over all its surface and the danger of trauma to the root is thereby reduced to minimum. Obviously however the power must not, either in extent or duration, exceed the limit for which the organ was designed. Therefore two problems conflict—that of giving the tooth optimum stability and that of distributing the strain for the protection of the root and, as a result, the vitality of the tooth. Each anatomical characteristic which strengthens the one function must, of necessity, weaken the other. True, the dental organ has a certain ability to accommodate itself according to continual changes in functional strain. Thus the root itself will often increase in size by cement apposition. The effectiveness of the periodontal fibres is increased by use. The bone reacts in such a way that this periodontal membrane becomes slightly thicker during increasing functional strain. These are well known matters in dental literature. The problem in connection with our research is, however, how the root, with its genetically fixed size and shape, is able to perform these two functions.

Before we begin to discuss this question we must first of all realise that the speed of the movement is a factor which must be taken into consideration. It is connected, as can be understood, with the viscosity of the fluid and the pliancy of the soft tissue, especially the consistency of the intercellular substance. The slower the movement, the greater the ability of the membrane to absorb the strain.

Fig. 10

Fig. 12 (left)



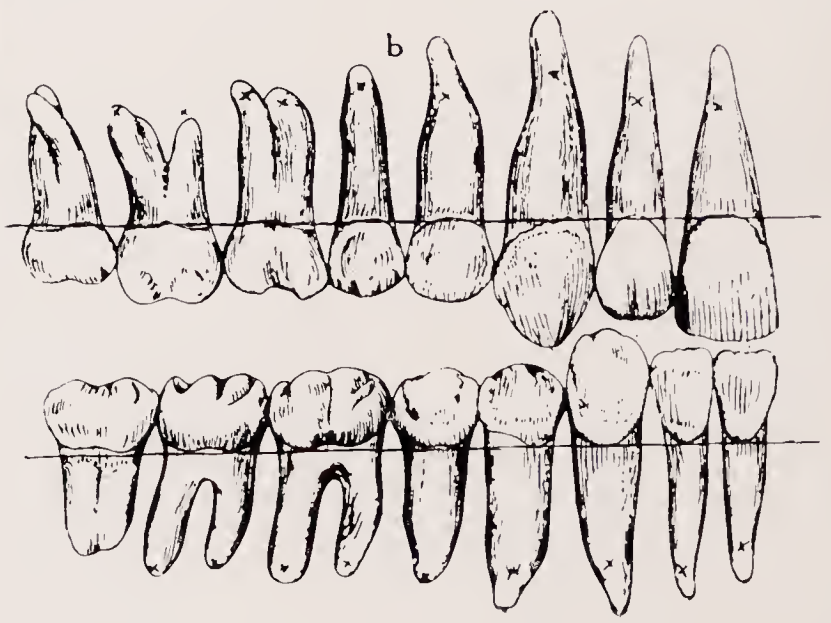


Fig. 11 (right)

If we imagine a tooth subjected to a purely axial strain by which it is pressed into the alveolus, the strain will be absorbed in two ways. The first we have just dealt with, that is, changes taking place along the whole root and making the fibres act like elastic. The second is the piston-like effect of the root against the fluid and soft tissue lying between the root and the bone. In this case a stouter root having a larger surface will create a greater resistance. Also the form of the root will influence the stability just as the bow of a boat will enable it to move more rapidly through the water ; and the greater the speed the greater will be the resistance against its movement. In some teeth the resistance will be made by the apical part of the root, in other teeth it will be the inter-radicular area which will offer the resistance.

If we further consider a tooth subjected to a purely transverse strain, we are inclined to compare the root to a lever. However, even here the same principle is the basis of stability as in the case of axial strain, namely the displacement of the fluid and the sluggishness of change in the tissues as previously discussed. Even with this sort of strain, a greater area produces greater stability.

It has been of interest especially in orthodontics, to discuss the question of how the root moves in the alveolus. Where is the imaginary axis around which the root pivots when it is subjected to transverse stress ? As previously stated, the mathematician Synge has made this question the object of comprehensive calculations. Others have uncovered a part of the root in order to be able to observe the position of the fulcrum ; I think we should differentiate between movement due to function and that due to prolonged strain because we do not know if the fulcrum is the same. The former is a question of stability, and the latter affects the fixative organs which we will discuss at a later stage. But in both cases the so-called pivotal axis will lie where the total stress above is equal to the total resistance below. This will vary from tooth to tooth and from one individual to another since all the three characteristics with which we are concerned—the length, division and stoutness of the root —vary. This is especially true of the apical section.

If we now take two equally long roots the one which has the thickest point will present the greatest resistance. It is better stabilised and the soft tissue of the apical area is better protected. The same holds true in the case of an equally long, but split root. The split one usually has the relatively greater surface area of two teeth of the same mass, and will accordingly offer a relatively greater resistance. We may perhaps, put it this way : of three teeth, the one which has a split root or the one which has an especially stout root will have better stability than the third which does not possess these characteristics. In order to even matters up, the last would have to have a longer root. Which of these characteristics are especially developed varies with different individuals and are naturally hereditary. Phylogenetically it seems that these characteristics have adapted themselves to other functions as well.

These reflections of ours about the physics of stability are verified by the results of the investigations to which I referred by way of commencement. By statistical probability a correlation has been ascertained between the length of a root and its divisionary degree. We also discovered that the male has longer roots, a greater frequency of division and a higher divisionary degree than the female. A greater mass of muscle and better possibilities of stability—both genetically determined—are, therefore, correlated.

However, no connection can yet be determined between the length of a root and its stoutness since no methodical investigations have been conducted. For the present I must content myself by stating the following : in our comparison of the Lapp with the Sinanthropus we find that the roots of the molars differ more in stoutness than in length (*Fig.* 11). The apical section of the Sinanthropus is huge, according to Weidenreich's illustrations. The Lapp on the other hand, has a very graceful jaw construction and has also thin, pointed molar roots. A correlation

between the amount of muscle and the stoutness of the roots, therefore, seems probable. In the case where axial strain dominates, that is in the molars, it is the stoutness which characterizes the roots. But we find that for the incisors and canine teeth, where transverse strain dominates, it is the root length which especially marks the difference.

There is much evidence to the effect that, both as far as the crowns of the teeth, with which I have not dealt here, and the roots are concerned, we are confronted by nature's law that the shape is more variable than the mass, and that the three characteristics in which we have been interested are, to a certain extent, different genetic forms of expression based on a power of development determined chiefly by heredity.

The phylogenetic connection between need and morphology which we must now assume but about which we know far too little, makes it interesting to consider conditions in different animals. Unfortunately I am no zoologist. You must accept what I say for what it is worth.

The pig has relatively high cusps with outstanding wrinkles (*Fig.* 12). As far as can be understood, it must be an especially well adapted construction of the crown to make effective a simple vertical chewing motion. The molar roots are very unsubstantially constructed and short. By way of compensation, the inter-radicular surface is very great. This must of necessity operate as an effective resistance to take the dominating vertical strain.

Turning to beasts of prey, the use of their premolars and molars is, on the whole, rather a scissor-like action. By a lateral motion of the head of the joint, the cusps of the lower jaw are kept close to those of the upper jaw during the process of biting, like the blades of scissors. The more pointed and the sharper the cusps, the smaller the transversal strain. The roots of the teeth of beasts of prey, and especially those of the cat family, are slender and not long—indeed they are surprisingly small, considering their great muscular power—and the cat family, in particular, have sharp molar crowns (*Fig.* 13). The first molars of the dog family, have, like those of the pig, a large inter-radicular surface, well fitted also to take the occasional great strain when something is to be crushed.

The stability of the molars of the horse and some cud-chewing animals is of great interest (*Fig.* 14). In the young animal we find that the part of the crown surrounded by bone is relatively long. The border between crown and root, however, lies very deep in the alveolus, and the anatomical root is very short in comparison to the crown. The root divides very close to the crown. The inter-radicular space is great, even if not as great as in other types of animals with which we have dealt. As may be understood, these molars must have good stability both for axial and transversal stress. Contrary to other animals and to humans, the greater part of the crown is surrounded by bone. The teeth, therefore, have a good stabilising organ, but probably a poor fixatory one as the root is short. The characteristic of their chewing function is, of course, the even rhythmical motion, apparently without any sudden strains. By contrast,

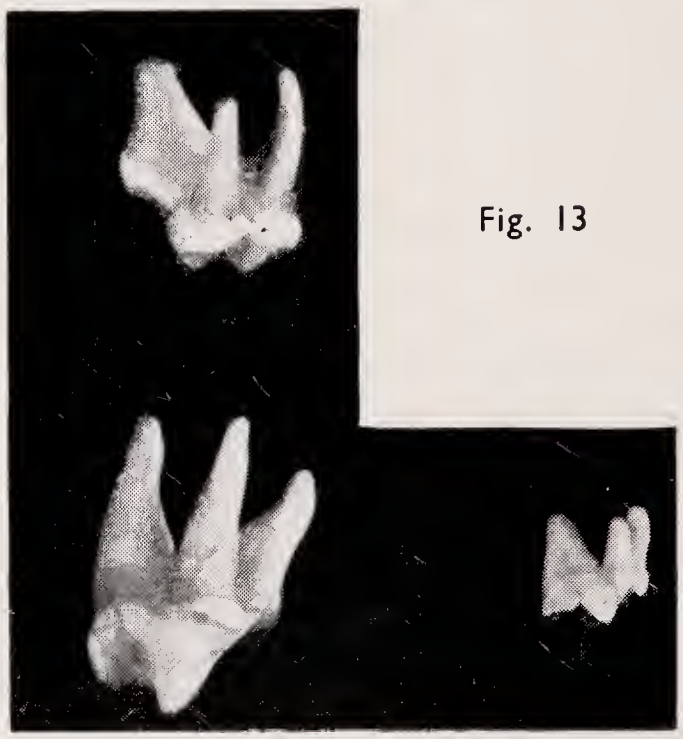


Fig. 13

Fig. 14

beasts of prey, for example, require sudden, powerful muscular effort. There is however another factor in connection with cud-chewing animals which it may be of interest to consider. The crown is gradually worn and the tooth is extruded from its alveolus. At the same time, the root increases in length and changes character. The inter-radicular space is gradually reduced to a narrow slit. The root branches become cylinder-shaped and I have seen cases where they terminated as a concave apical surface. While the axial strain in the young animal is taken up mostly by the inter-radicular surface, the stress in the old ones is moved to the apex.

Gorjovanic-Kramberger has demonstrated an unusual root shape termed *taurodontism* in the molars of Krapina man. The root division is in the apical third. The apex is rather like a dish-shaped surface. This brings to mind the molars of cud-chewing animals and the root shape that occurs there with age. In Krapina man we find a molar shape in which the axial stability is chiefly transferred to the apical section, and even in some cases, to this strange concave apex.

This root shape has, as is to be expected, provoked a thorough discussion as to its phylogenetic meaning. According to different investigations, both of fossils and of living subjects, we seem to be confronted by a racial characteristic. Pedersen (1948) has recently pointed to a relatively high frequency of taurodontism among the Greenland Eskimos. The extent is, however, less than among Krapina man. Among the Lapps on the other hand we never find such a tendency at all. This contrast between the root shape of a robust and muscularly built race like the Eskimos and that of the gracefully built Lapps is well worth closer study against the background of what we have already discussed. These examples seem to strengthen the belief that the root is to a large extent formed by the necessity for reasonable stability.

Hitherto we have been discussing stabilisation. This comprises two things which are in opposition to each other but which seem to be wonderfully adapted to each other, namely, resistance in order to produce an effect, and pliability in order to protect. This is obviously made possible partly by purely genetic construction and partly by the adaptability of the different elements of the dental unit, that is the tooth, the surrounding soft tissue and the bone.

The second point with which we will now deal briefly is fixation—the fact that the tooth is held fast under further strain.

During normal use of the tooth, the two functions, the elastic absorption and the solid resistance, merge with each other. When the fixation occurs the force is spread along the whole root. If the strain becomes especially long drawn out or great, there occurs a danger of injury to the fibres. For fixation a root shape which makes the strain per fibre unit a minimum will therefore be the best. For a tooth which is mainly subject to transverse strain a long root has advantages over a shorter one, whether the latter be divided or not. The strain on the fibres becomes less the further the apical bundles are separated from the cervical ones, and the more fibres for which there is room.

A canine tooth which grips and holds fast—and which in human beings cuts and divides the food—is the object of a more lasting strain than the premolars and molars, which work more rhythmically. This, then, presupposes that the conditions for fixation are especially favourable with the canine teeth. In many animals, especially beasts of prey, the canine has the same characteristics as a dagger which grips and tears. This gives a very long drawn-out strain. We find in these animals a long but not always a very thick or stout root.

The following illustrate examples between stability and fixation. For instance, if a first incisor is given a transversally directed shock of great speed, the not uncommon result is that the apical area of the root is fractured, while the crown perhaps, remains undamaged. We may in other cases be confronted by a trauma after a great strain of a slower nature, where the tooth itself is undamaged but the fibres and bone have given away. In both cases the tooth is subjected to a

strain which exceeds the maximum functional one. In the first example it may be that the speed has been too great for the elastic stabilising function to be effective. In the second, the time has been long enough for the force to be taken up and the tooth protected, but the time and the force *together* have exceeded the power of resistance of the strengthening tissue under the given anatomical conditions.

During our discussion of the problems of fixation we must not overlook the great sensitiveness to pain which the periodontal membrane has, and which is an effective warning system of overstrain.

Up to the present we have simplified the problem by explaining the results of a purely axial and a purely transverse strain, and we have attempted to show the root construction as a stabilising and fixatory factor under these two conditions. But in reality a functional strain in the human being will always be partly vertical and partly transverse. The relationship between the two types varies from tooth to tooth, however. This resultant type of strain makes the whole problem considerably more complicated.

When an oblique force strikes a single-rooted tooth, the tooth will be pressed into the alveolus and it will also tend to tilt. The shape of the root seems to be formed to withstand pressure from a definite direction. There is usually a thickening on the middle third of the root, flattening on the labial surface and sharpening on the lingual. The contours are much more marked in Sinanthropus than in the Lapp.

The force on the upper first molar is directed obliquely *inwards*, the lingual cusp taking the main pressure. Considering the root system as a whole the contours assume a similar character to single-rooted teeth. Usually the apical section of the lingual root of the upper first molar curves toward the buccal root. This enables the tooth to behave in a similar manner to a single-rooted tooth.

Fig. 15 is a simple experiment of thoughts in an endeavour to seek a connection between morphology and movement.

We have discussed the three characteristics, the length, division and stoutness of the root, as of nearly equal importance in the service of *stability* during a transverse

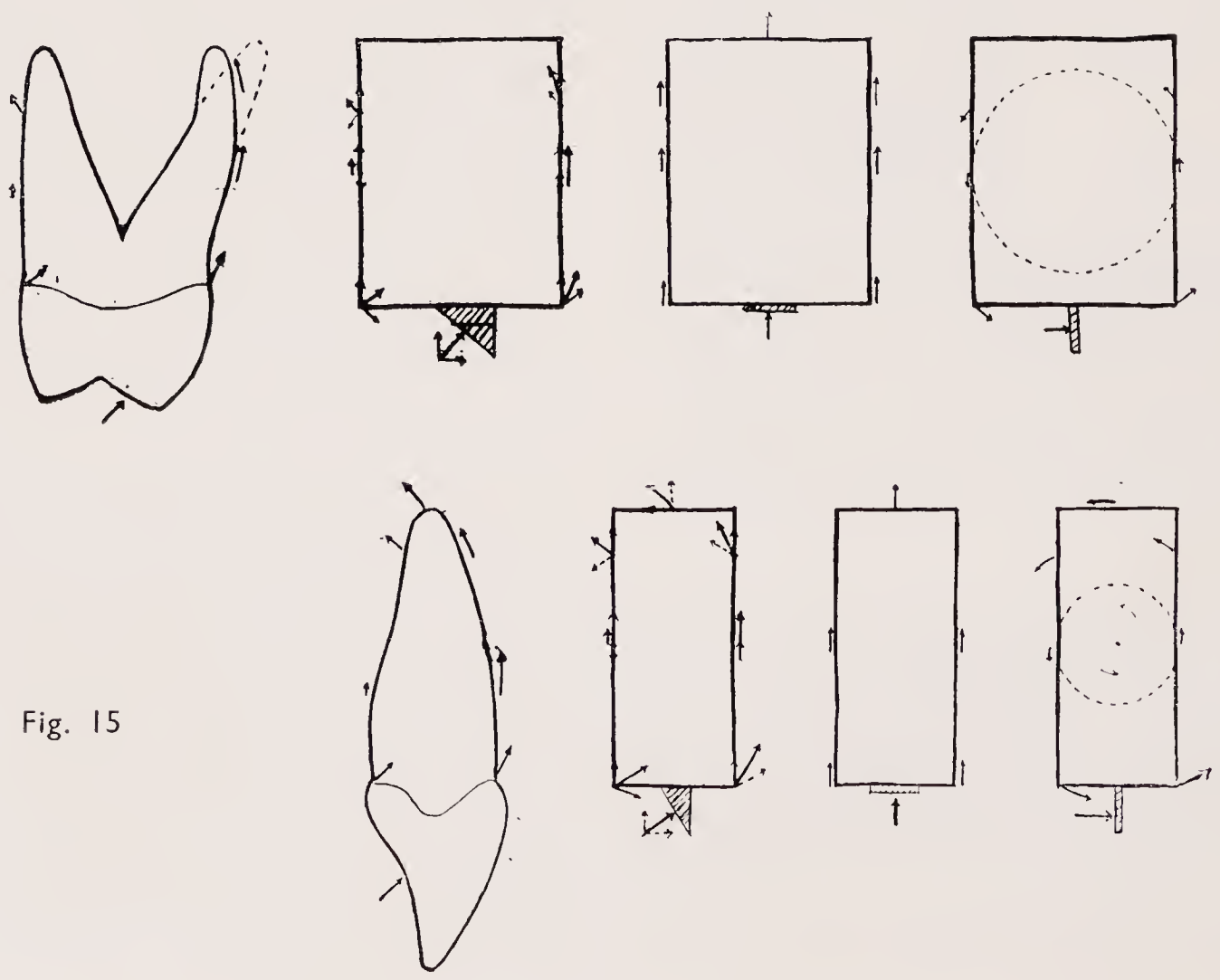


Fig. 15

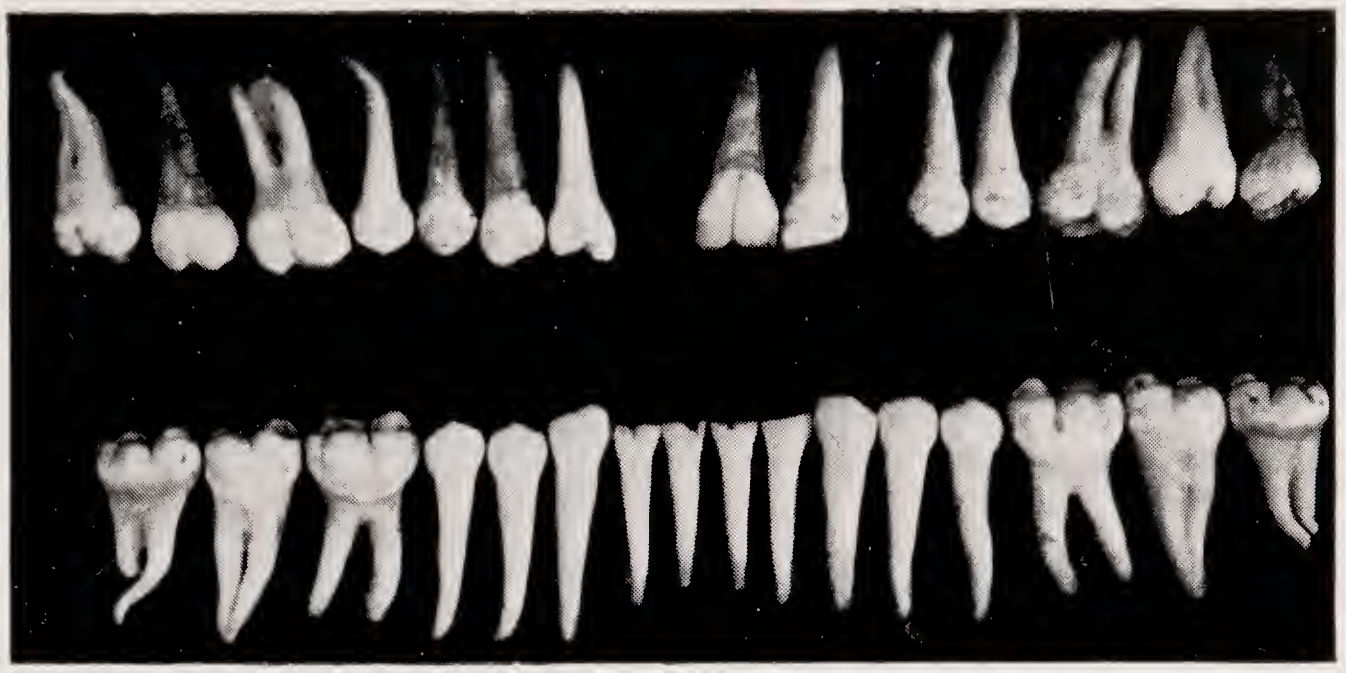


Fig. 16

strain. But we have stated that for *fixation*, the length of the root plays the greatest part. During the phylogenetic development of the root of the front teeth, and especially of the canine teeth, it would appear that the need for *fixation* has dominated, whereas for the molars, which work with the rhythmical movement of the jaws. it has been the need for *stability* which has dominated.

Let us again consider our two friends—Sinanthropus and the Lapp. Even if we do not know anything of the relationship between them they are both extreme representatives, each of his own day. From these two extreme examples of ancient and modern man there can hardly be any doubt that evolution has brought with it a great reduction in the mass of both crown and root (*Fig.* 11). As far as the roots are concerned, we find that this reduction has been at the expense of those characteristics which are of the greatest importance to the individual teeth during their function. As functional need has become less so these characteristics, namely, the *length* of the canine teeth and the *stoutness* of the molars have become less necessary. This has not, however, prevented evolution from following other lines because other functions have altered.

We remember from the beginning of the lecture, that the small crown of the second molar in the upper jaw of the Lapp is equipped with exceptionally long roots, which, at the same time, are slender and pointed ; (*Fig.* 16) the second molar shows more signs of a transverse strain than do those of, for example, the Sinanthropus. According to my studies, the second molar is the one which, more than others, has been the object of evolutionary changes. The crown has diminished in circumference. This does not mean to say that it has degenerated ; it may be that as a result of an evolutionary process, it more than other teeth, has changed its character to conform with the concurrent changes in the construction of the cranium.

What I have said tonight bears the imprint of a working hypothesis. There are many matters which require closer study. These are ideas and reflections which have forced themselves forward amid the working out of a specialised anthropological matter. But speculations do not belong to the scientific work which I am going to publish. On the other hand, however, it is not right to withhold one's thoughts if one believes that they can help further research. When, therefore, I was honoured by being invited to give the Northcroft Memorial Lecture it gave me a favourable opportunity of expressing my views in the verbal and freer medium of the lecturer.

I would especially like to thank the Council of the British Society for the Study of Orthodontics for asking me to give this lecture in memory of the founder of their Society. I have a sincere admiration for the work of Dr. Northcroft in advancing the study of orthodontics, and for encouraging men in all countries to carry out investigations to add to our knowledge of orthodontics.

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DISCUSSION

The President said the Society was most indebted to Professor Selmer-Olsen for a very thoughtful and interesting paper and for bringing up the points he had referred to. He himself would like to take up the little point about the periodontal membrane, because he had always understood the fibres of the periodontal membrane were elastic. Prof. Selmer-Olsen suggested that although they were concertina-shaped, and returned to that same concertina - shape after being stretched, they owed their elasticity to the intercellular substance which was round them and which provided the resilience. He would like to ask whether that was the case and whether those substances were of the nature of cotton-wool which slowly absorbed pressure or were of some viscous fluid like treacle.

He then called upon Professor Friel to open the discussion.

Dr. S. Friel said the Society had been very fortunate in its choice of Northcroft lecturers—Professor Harris, Dr. Lindsay, and now Professor Selmer-Olsen. Each of these lecturers had added something to the knowledge of orthodontics, and he thought the subjects of their lectures would have appealed to Dr. Northcroft. He would like to congratulate Professor Selmer-Olsen on his lecture. He did not think the Society had been so wise in their choice of the person to open the discussion. They should have chosen an

anatomist or somebody of that nature to do it.

If one had been working for sixteen years on five hundred Lapp skulls, though one had a main object in view, nevertheless various side problems must continually intrude and make one speculate as to their meaning. Personally, he would not be able to look at five hundred skulls for sixteen years without his mind wandering a great deal. The side problem that Professor Selmer-Olsen had now discussed was fixation and stability in relation to root form. He brought in the old controversy whether morphology was the result of function or whether morphology was of genetic origin and survived because it suited function.

As root form takes place long before function comes into action, it is entirely of genetic origin and survives because it does its job of work. Perhaps that was not the Russian view. They might think that function had altered the form of the root to suit their particular purpose and that it had been impressed on the germ plasm.

Professor Selmer-Olsen had drawn attention to the slenderness of the jaws of the Lapps and had also said they were ' strong of sinew.' Mass in itself was not a sign of strength in a bone. Surely the denseness and thickness of the cortical area of the bone and the quantity of the trabeculae within the bone were equal to a much stouter bone with less dense cortical area and less trabeculae.

The distinction that was drawn between stability and fixation of roots was most interesting and observations were made on the means by which stability was obtained in relation to different forms of roots—length, division of root and mass of root. They all appeared to obtain stability suitable to their function in the premolar and molar region. The greatest difference seemed to be between the cud-chewing animals with their side to side motion and the cat family, a purely up and down motion. Mass and rhythmical movement went together but length and division of roots appeared to withstand more sudden strains. Division of root could again be divided into length of division and degree of divergency. It seemed to him that stoutness, length, division, length of division and divergency of roots were all designed for the same object —greater area for the attachment of the periodontal membrane. That applied to molars and premolars.

When one came to the canine, conditions were different. Its function was often different in the two sexes of some animals, such as the baboon. In the male it was a fighting instrument and not just used for tearing and dividing food. The canine root of the male was very long and stout, in comparison with the roots of premolars and molars. It had to withstand tremendous strain in many directions, and as Professor Selmer-Olsen had pointed out, fixation predominated over stabilization.

The morphology of the Lapp incisors was difficult to understand. Professor Selmer-Olsen said they used their teeth not only for biting food but also as tools. The crown of the first incisor was long and yet the root seemed to be extremely short and was lying at an oblique angle to the direction of force. One would imagine that transverse strain here predominated over vertical strain and yet one had everything against stability—long crown and greater leverage, short root and less power of resistance to leverage. Perhaps Professor Selmer-Olsen would explain this apparent incongruity.

It was a most interesting lecture and opened up a whole new field for investigation.

Recently he had received from East Africa a collection of skulls of varying ages of two types of monkeys—the common baboon and *cercopithecus aethiops*. There were about ten to twelve in each series. He had been interested in their occlusion and now Professor Selmer-Olsen had given him a new interest—the form of their roots. So far he had only had the *cercopithecus aethiops* radiographed. The length of the roots compared to the length of the crown in the premolar and molar series appeared to be marked. The roots were divided and the division was near the pulp chamber with very considerable divergency of the roots. Stability had been obtained in quite a different way to the Lapp method.

Professor Selmer-Olsen had drawn attention to the upper second molar of the Lapps—the great length of its root compared to the other molars and its variability. In other races of men it was also a variable tooth. The crown could be similar to the first molar with a reduced disto-lingual cusp, it could be far wider bucco-lingually and narrower mesio-distally than the first molar. It could also be a three-cusped tooth. He considered that this tooth in the Lapps was the object of evolutionary change, owing to its variability, and he (Dr. Friel) thought the same could be said of this tooth in other races. Whether it was coming or going one did not know.

There was one other point he would like to mention—the frequent division of the root (he was speculating now) of the upper first premolar. The upper tooth from the form of its root was able to withstand considerable strain, far more than the lower tooth. Was it similar to a hammer driving a nail into wood ? The lower first premolar was the head of the hammer, the jaw bone the handle and the temporo-mandibular joint the wrist joint, the upper first premolar the nail and the skull the block of wood ; the division of the upper root being formed to frustrate the action of the hammer.

He did wish to thank Professor Selmer-Olsen most sincerely for his very interesting paper.

Mr. Russell Logan said he would like, in the first place, to endorse Professor Friel's opening remarks, more particularly as to the inadequacy of the second speaker asked to open the discussion that evening.

He had been much intrigued by Prof. Selmer-Olsen's choice of the Lapps for his investigations. They were in many ways a unique people. They were the smallest race in Europe, although they were not the smallest in the world. He was most interested to learn that Professor Selmer-Olsen adhered to the theory that they were the descendants of an offshoot of the human stock before the division into Caucasian and Mongolian had taken place. His paper, to which they had listened with such interest and pleasure that evening, was an essay on the relationship of form to function.

He must confess that he himself found this a most difficult subject to come to terms with. When he was young he had always been told to be a good boy and eat his nice hard crusts, as the exercise would make his jaws grow big and strong. He had not believed that then and he did not believe it now. In the Lapps they had a strain of the human race which had exercised its jaws (for many generations) to a degree unbelievable to modern town dwellers, and yet the jaws remained small relative to the skull, giving the typical oval shape to the Lapp face in its lower regions. One could not produce in a strain a more massive jaw structure by exercise. But, of course, one could produce a smaller skull structure in any individual member by malnutrition. It must be remembered, when considering the problems of phylogenetic development, that in a strain inheritable alterations in form could not occur directly as the result of the influence of the environment on the somatoplasm of individuals. To put it more simply, and perhaps more crudely, the fact that a man had lost a limb in an accident did not mean that his children would show the same condition.

Inheritable changes in morphology resulted from what was known as a mutation which was nearly always a spontaneous alteration in the structure of the germ plasm and occurred quite at random. The chance of the perpetuation of the mutation was very small for the following reasons. In the first place, most mutations were recessive in character ; that was to say, they could not reproduce the variation in shape in individuals of the next generation, because they must combine, in mating, with the germ plasm of an exactly similarly mutated individual in order to show the change, and so many hundreds of subsequent matings might take place without the reappearance of the altered form. In the second place, most mutations resulted in changes for the worse. Many were incompatible with life. Hence, the chances of survival of the bearer of a mutation were relatively small. Very rarely a mutation produced a change for the better in which case the happy individual might be in a position to produce more offspring than his fellows. If

the mutation affected, say, only the length or the division of a bicuspid root, it was very difficult to see how that was likely to be perpetuated with any speed at all, all of which went to show how difficult it was for an alteration in the morphology of a strain to occur and how comparatively stable was the structure of man who bred so slowly.

With regard to the stability of the incisors of the Lapps and the extraordinary shortness of the roots, he would like to ask the speaker what he had found was the state of the occlusion in the incisor region. If the edge to edge type prevailed, one would expect less lateral strain than if a deep over-bite were present, and this would go further to support Professor Selmer-Olsen's thesis that the length of root was proportionate to the degree of lateral strain.

He was not able to evaluate the speaker's statistics, owing to a deficiency in his own education. He noted that they were to have the pleasure of hearing Professor Hans Grüneberg on the subject of genetics, and he brought it to the notice of the Committee that it was high time they had somebody to explain to them the latest developments in medical statistics ; it was a subject on which he found himself profoundly ignorant at a time when statistics were being increasingly used.

They were gathered together that evening to honour the mighty dead, and all who were present must acclaim the importance of the many contributions made by George Northcroft to their knowledge of their craft.

By their choice of Selmer-Olsen as their Third Northcroft Memorial Lecturer they showed their homage to the living. The wealth of observation, the depth of knowledge, not to mention the lucid manner in which he had marshalled his subject for them in an alien tongue, had doubly—nay trebly—vindicated their own opinion of Selmer-Olsen as one of the great thinkers of their profession to-day.

Professor M. A. Rushton said he found it very difficult to discuss this extremely complicated question. Since the evolutionary standpoint had been mentioned, he thought it might be interesting to cast the mind back to the primitive reptiles who, it would be remembered, had anchylosed labryinthodont teeth which no amount of tugging or pulling or orthodontic treatment could possibly have moved. When some reptiles —he supposed in the Permian Age or before—started having socketed teeth, great advantage was achieved in some respects. Perhaps they were less easy to break and they were able to continue to erupt to compensate for wear. But a new hazard was introduced, namely that with excessive force they could be moved through the bone. The manner in which that hazard had been overcome by various surviving races of animals had been analysed in the most persuasive manner by Professor Selmer-Olsen, and he was wondering whether the adaptation to expected function had concerned not only the form of the root but might also have concerned the bone.

One question had long perplexed him and perhaps other people. If one considered an upper incisor tooth one had good reason to think that such a tooth continually sustained, on one aspect of it, very much more heavy and repeated forces than it did on the other. Yet that tooth did not move through the bone, whereas if a small force were applied to it in an unexpected direction, then it moved comparatively easily. He would like to know whether the reason why that tooth, although chiefly bitten on one side, did not move through the bone was entirely explained by the two mechanisms Prof. Selmer-Olsen had mentioned—first of all, the hydrostatic buffer mechanism ; and secondly, the collagen fibre suspension method which spread and dissipated the forces, so that at no point did the force reach a threshold, sufficient to cause absorption of bone ; or was there any difference in the reactivity of one part of the bone as compared with another so that it would withstand more pressure in one place than in another ?

The only other thing he would like to ask was whether one met many of the Krapina type of teeth in Norway at the present time. They were sometimes seen in England, usually first upper molars.

The President said that Professor Selmer-Olsen's paper was now open for general discussion.

Mr. Maxwell Stephens said he thought the paper bore the mark of a great mind, and the Society was particularly fortunate in having Professor Selmer-Olsen to address it. The paper had been very ably discussed by three of their 'orthodontic pillars,' and he did not think there was anything to reproach the Council with their selection.

As many of those present were not practising orthodontics exclusively, he thought the moment should not pass without attention being called to the fact that such a paper was of the very greatest value to everyone who was practising dentistry, and he thought everybody should apply himself to studying it. The paper for what it told was not always the most important part of the evening: its real value was in what it sent people home to think about. Many of those present, were conservative dentists as well as orthodontists, to a point also they practised exodontia and rehabilitation of bites. In all these aspects and many others, the consideration of such a paper was of the greatest value. He would like to thank Professor Selmer-Olsen very much.

Mr. Harold Chapman said Professor Selmer-Olsen had given a wonderful study in comparative dental anatomy—human as well as animal.

He was struck by the fact of the long root having greater resistance, and he seemed to remember in one of Dr Angle's early writings his attempt to remove a lower canine by means of molar anchorage, whereas the molar gave way and the canine stayed. He supposed that was a practical confirmation of what they had just been told.

Another point which arose in the mind of a practising orthodontist was whether Professor Selmer-Olsen's remarks referred, as regards division of root, to deciduous molars in the same way, or whether they came under a different heading because of the division or diversion of the roots in order to accommodate the deciduous molars, or in that case were the two functions served ?

He would also say he was surprised that the lateral strain on the incisors was so great: one seemed to remember that in Oppenheimer's histological sections where teeth had been moved, or before they had been moved, the points of the trabeculae ran in the same direction in molars and premolars, whereas one would expect that the strains were so much in the transverse direction that they would be varied. He would be glad to hear from Professor Selmer-Olsen what he had to tell them on that point. He had undoubtedly some other similar correlated observations that he could make after sixteen years which would interest them from the point of view of practice.

He wondered, too, if Professor Selmer-Olsen could tell them—as there was a difference in the males and females as regards teeth—how to distinguish male and female mandibles. He remembered a Professor who was in charge of the Anthropological Museum in Washington, saying he could tell at a glance whether a mandible belonged to a male or a female. That was a mystery to him (Mr. Chapman) then, and it was a mystery to him still. He hoped they had found someone who could explain that to them.

He would also like Professor Selmer-Olsen to elucidate one other point—the question of prolonged strain. Did that ever occur in animals, or was it only produced by the orthodontists ? That would be a fascinating subject for study.

The President said that Professor Selmer-Olsen asked to be excused from answering all the questions at once. He would prefer to answer them in writing. He would, however, like to reply to Professor Friel.

Professor Selmer-Olsen thanked those who had discussed his paper and expressed appreciation for all the kind words that had been spoken.

He wanted to thank Professor Friel for his comments: he had put his finger on some very interesting points. One of these related to the short root of the first incisor. It was often very short. If he

could have the slide again, he could show them the most interesting matter.

It would be noticed that the upper first incisor and the lower first incisor in the position in the jaws showed a root of 6.5 mm., and that meant if one took 2 mm. not surrounded by bone it would give 4.5 mm. surrounded by bone. That was a very short root, he thought.

The first thought was that there should be some resorption on the root. He had examined it and more of the same kind, but he did not find any clinical symptoms of resorption, so he did not think it had happened. Another idea seemed more probable and he had just touched on it in his paper. A permanent increase of function increased the strength of the fibres and if a tooth had been out of function for a long time, it would not be able to do the work well for a long time. It seemed probable, therefore, that the fibres laid on the cement adapted themselves to the need and the given inherited conditions, but if he were asked why the root was so short he would not be able to answer.

There was one other point he wanted to make. There might be a correlation between the length of the first incisor and the height of the alveolar process, because that was very short too, but he did not think that was the reason why the root was short.

The second molar had been mentioned, and this answer might also be an answer to Mr. Logan too. It related to evolution. It was very much the same in all races, and he tended very much to the theory of Weidenreich that what had happened in man was a kind of secondary evolution, an adaptive effort, a main mutation taking place in a general steering gene millions of years ago. What was happening now was just adaptation, secondary evolution. He thought what Professor Friel had said about the divergency of roots was correct. He had thought it over himself but he had not been clear in his own mind, so he had not mentioned it in the paper.

He thanked them all very much and begged to be excused from answering all the questions. He would try to give the answers in writing. (*Applause*)

The President, in closing the meeting, said they had had a wonderful evening. They should imagine themselves in the position of going to Oslo and reading a paper in Norwegian and then having to answer all the questions fired at them. They would then know exactly how Professor Selmer-Olsen must feel that evening. He would ask them to give a hearty vote of thanks in the usual way.

(*Applause*)

The proceedings then terminated.

* * * * *

A CASE OF MICROGNATHIA AND MICROGLOSSIA

By R. B. DOCKRELL, M.B., B.Ch., B.Dent.Sc. (U. Dublin)

THE PATIENT, a girl aged 4 5/12 was brought to me by her parents who said that she had difficulty in chewing.

Family History :

She is the third child out of four having two brothers aged 14 yrs. and 4 yrs. and one sister 4 months old. They are all normal.

Previous History :

The labour was normal—she weighed 6½ lbs. at birth. She had haemorrhagic disease of the newborn and her parents were told she would not live. However, she survived, and at this point one of the doctors seems to have noticed that she had no fraenum to her tongue and said that she might swallow it. There is no record that he noticed anything wrong with her jaws but it seems likely, as he suggested bringing her to an orthodontist when she was 4 years old. The teething history is vague but her parents believe that the teeth erupted in the wrong order. Feeding has always been difficult ; she has had to be fed on soft foods and even now each meal takes an hour. Otherwise she has been very well. There is no family history of any anodontia.

Examination :

Appearance A fat child of average size.

Face Appears quite normal.

Teeth The upper jaw has a full deciduous dentition with crowding of the incisors.

In the lower jaw, she has one incisor, both canines and all the deciduous molars. She is therefore missing 3 deciduous incisors. The molars are not as fully erupted

Fig. 1. *a, b, c.*
Full face and lateral views of the patient. In the right lateral view, *Fig.* 1*a*, the small lower jaw can be seen. This is not the patient's usual rest position which is as shown in *Fig.* 1*c*.

(a)

(b)

(c)

as one would expect and there is a lot of caries in them. The lower arch is very small and the lower teeth occlude completely lingually to the uppers.

Tongue

The tongue is a small one which seems to vanish completely when it is retracted. It can be protruded about $\frac{1}{2}''$ beyond the lower incisors and this movement is made possible by the very mobile floor of her mouth which is raised early in the protrusion.

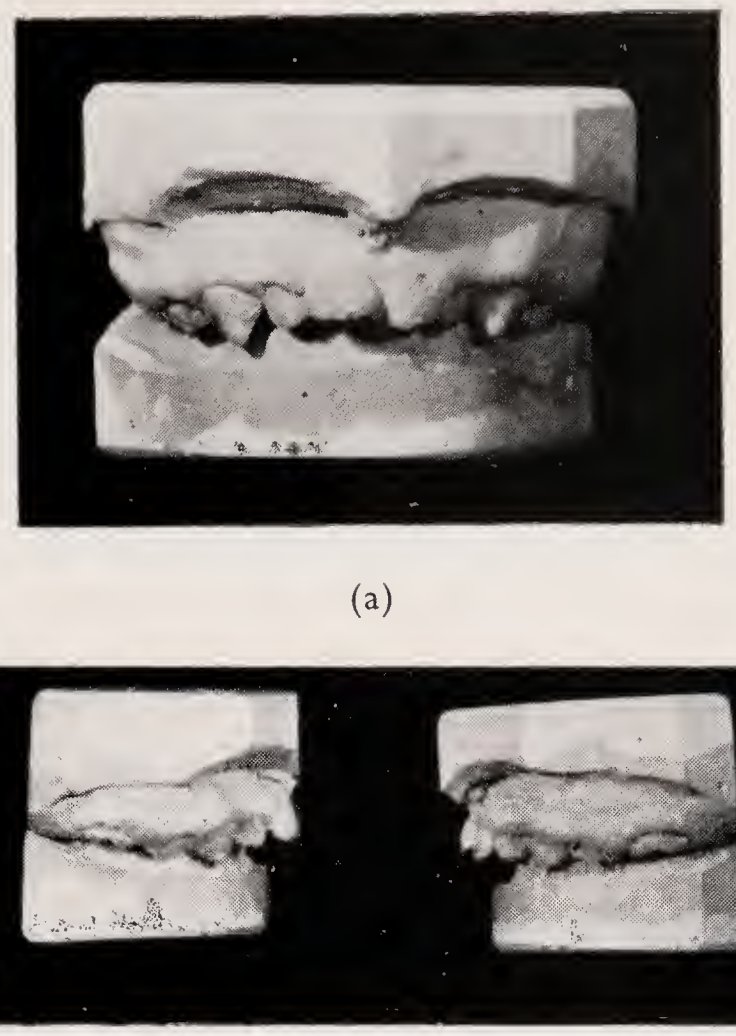
Speech

Is rather thick and is not up to normal for a child of her age.

No other abnormality could be discovered.

X-rays :

The upper permanent teeth are all present and in the lower there is one incisor, both canines, the 1st premolars and the 2nd molars. Therefore there are 3 incisors and 2 premolars missing in the lower jaw. There is not yet any sign of the 3rd molars.



(a)

(b) (c)

Fig. 3. *a, b, c.*
Full and lateral views of occluded models. The lower teeth are in post-normal relationship and completely lingual to the upper teeth.

Fig. 2.
Occlusal view of models. The distance between the cervical margin of the medio-lingual cusps of c-c is 12.3 mm.

Discussion :

Agnathia and hemiagnathia are fairly common in sheep, where the affected animals are called " hog-jawed " and always die early. It has also been investigated in human foetuses by Gladstone and Wakeley.[1] It is a possible cause of many abortions but, as it is incompatible with life, dental histories are not obtainable. Most of the reported cases of micrognathia appear to be due to injury to the condyles at birth or later and I can only find a record of one case similar to this in dental literature. Watkin,[2] in 1924, described the case of a girl aged 12 years in whom the anterior two thirds of the tongue were missing. Three incisors and two molars were absent in the lower jaw and in the upper, one premolar and two molars. This case showed tremendous hypertrophy of the sublingual gland. In addition, the viscera were transposed.

We must I think, postulate a common origin to the disturbances to the three

organs and it is difficult to see how it can be hereditary as the affected organs are similar only in their situation. Anodontia, partial or complete is not uncommon and does run in families, but if there is any association it is with defects of the hair, nails and sweat glands and not with defects of the tongue and jaws. Small and large tongues have been described but the jaws and teeth are normal. So there does not seem to be any question of linked or pleiotropic genes. This would mean that many genes are affected at once and it is suspicious that all the affected genes are for contiguous structures. Not much reliance can be placed on the negative family history as families are naturally vague and if it manifested itself in the more severe form, agnathia, the result would be an abortion or a miscarriage and the family would not know the condition had been present. On the other hand there is a period in the 4th week when the potentialities for the lower lip, the lower jaw and its teeth and the anterior two thirds of the tongue all lie in a rapidly growing, and therefore presumably more vulnerable, area, the mandibular process of the first branchial arch.

If that process were initially too small or if, since at the first, mandibular process grows more rapidly than the maxillary, a physical agent were to act for a short time, it would be possible for the mandibular process to be affected and for the maxillary process to escape.

Watkin's case could then be explained by an agent acting less strongly over a longer period producing less disturbance in the lower jaw but also affecting the upper jaw and causing transposition of the viscera.

Acting on this assumption I approached the patient's mother and asked her if the pregnancy had been normal. She stated that she had had a bad attack of nephritis beginning 24 days after her last period, that is when the foetus was roughly from 10—14 days old, and lasting three weeks.

It is not possible to say definitely that this is the cause but it seems very likely that during this time some toxin crossed the placenta and injured the growing foetus.

References

1. Gladstone and Wakeley. *J. Anat.*, 57. p.153-169, 1923.
2. Watkin *Trans. B.S.S.O.* 1924 p.37-38.

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DISCUSSION

The President said that he was grateful to Dr. Dockrell for bringing such an interesting case before the Society. He would be delighted to see what Dr. Dockrell did in the way of treatment in a few years' time.

Mr. H. G. Watkin said that in the case which he had, to which Dr. Dockrell referred, the viscera were entirely reversed.

Dr. Dockrell said that was not so in his case. Having read about Mr. Watkin's case, he had examined his patient and, very much to his disappointment, he had not been able to find any transposition of the viscera. That was what led him to suspect that if there had been a physical cause acting in Mr. Watkin's case it must have acted over a longer period.

* * * * *

ANIMAL GENETICS AND ORTHODONTICS

By DR. HANS GRÜNEBERG.

THE TITLE OF THIS PAPER is perhaps somewhat misleading. In the limited space available, it would be impossible to give an adequate survey of the whole field. I shall thus confine myself to those few cases which have occurred in my own research during the past 16 years. This work has had no orthodontic aims ; the material encountered is thus in the nature of by-products and for that reason lacks the coherence of an organised piece of research. However, these short-comings are perhaps partly compensated by the fact that the type of material is probably less familiar to this audience, and that it is presented and discussed by somebody who is completely innocent of any acquaintance with orthodontic literature.

It seems that orthodontics is largely the result of the fact that, with the possible exception of early embryonic stages, the developing body lacks the powers of regulation almost entirely. Once an anomaly has arisen in development, the body seems to make no attempt to put matters right though this could often be achieved quite easily by a little differential growth in one place or another ; in the whole of my experience of developmental genetics, I have not come across any evidence of *developmental* regulation, though instances of *functional* adaption are quite common. That some typical orthodontic situations are a consequence of this defect I shall demonstrate by a few observations which, in a similar form, are presumably quite common in Man.

A proper occlusion of upper and lower teeth necessitates an exact spatial relationship between upper jaw and mandible. This alignment may be disturbed at an embryonic stage. In a case of congenital hydrocephalus in the mouse (G., 1943) which is due to a simple recessive gene, there is a transitory anomaly of cartilage formation, chondrification being delayed by about 24 hours ; this has no serious consequences in most parts of the body, but, as shown in *Fig.* 1, it leads to a serious shortening of the basicranium, as its two constituent plates join with a delay, if at all. One of the results is a shortening of the upper jaw as compared with the mandible which protrudes anteriorly ; if the incisors were to erupt, the lower ones, instead of grinding against the upper ones from behind and below, would come to lie in front of them and consequently would not be worn off by use ; actually, this situation does not arise in this case, as the hydrocephalics die immediately after birth and thus do not reach the age at which their orthodontic anomaly would become operative.

In other cases, a similar anomaly can arise much later in development. In a recessive condition in the rat (G., 1938), a " hypertrophy " of the cartilage leads indirectly to a variety of anomalies ; one of the remoter of these is a delay in general growth. Now, as shown in *Fig.* 2, in the young rat, the upper jaw is still in a position which would lead to an edge-to-edge bite if the teeth were to erupt at that time. However, a rapid elongation of the upper jaw takes place within the first week or so, and by the time the incisors erupt, the upper jaw is suffici-

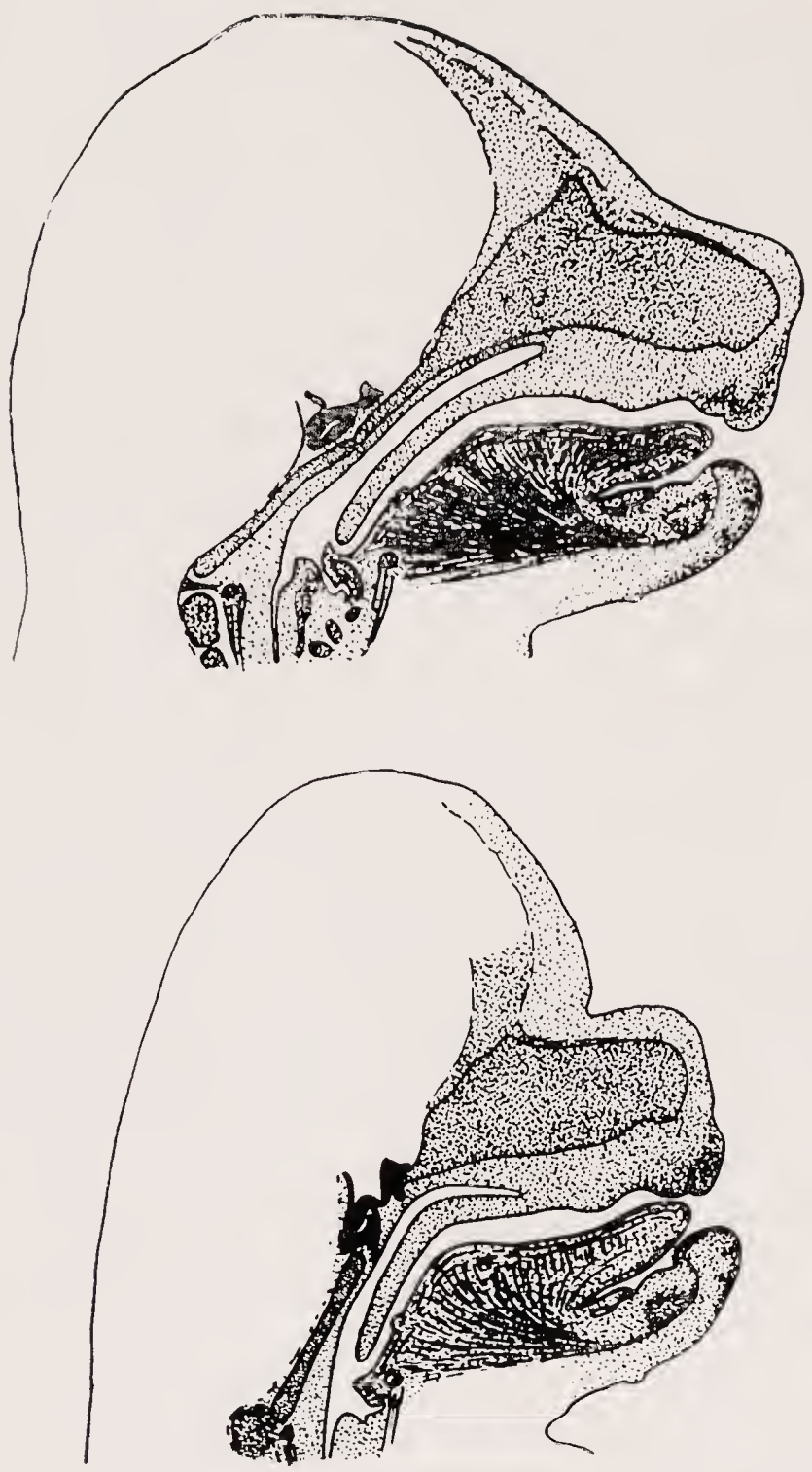

Fig. 1.

Sagittal sections through the heads of a normal and a hydrocephalic mouse embryo, 16⅔ days old. In the abnormal animal, shortening of the skull base has been brought about by a delayed fusion between the anterior and posterior half of the basicranium. The mandible has thus become " undershot." From Grüneberg, 1943, by courtesy of the *Journal of Genetics*.

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ently in front of the mandible to ensure a proper occlusion of the incisors. In the abnormal animals of my strain, the elongation of the upper jaw did not take place ; so the teeth, when they erupted, did not occlude properly, which in a rodent is a much more serious affair than in Man ; in fact, some of the animals had the lower incisors in front of the upper ones so that they could not feed properly, and others just managed on an edge-to-edge bite.

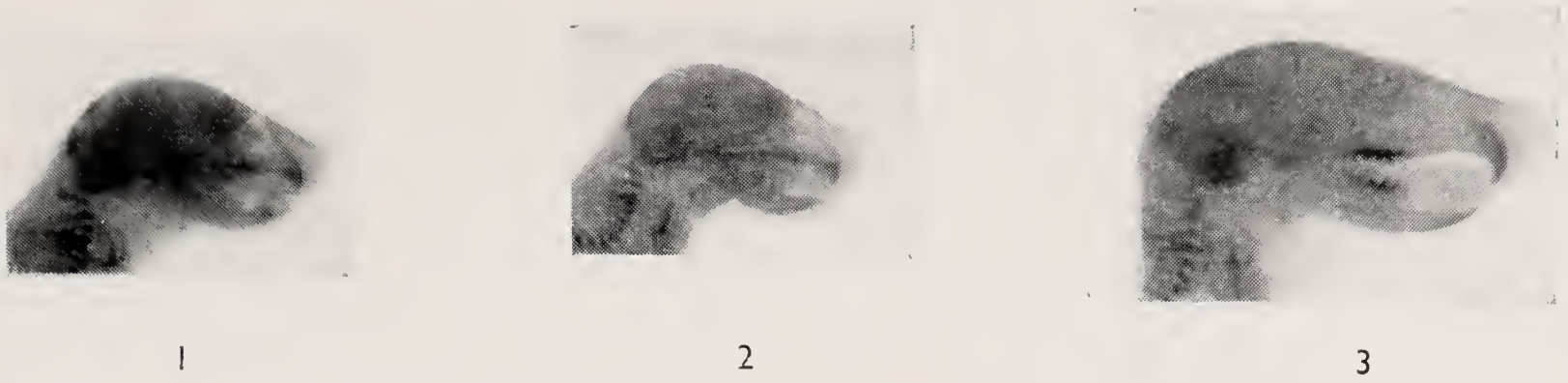
The two cases differ from each other in that in the mouse, the shortening of the basis of the skull was rather directly caused by the gene, whereas in the rat the effect was a very remote one ; it was indeed a consequence of a general slowing down of differentiation which, in a similar form, might have been produced by a variety of different mechanisms.

In other cases, the developmental mechanism is not yet clear. In long-haired dachshunds (Grüneberg & Lea, 1949), there exists a recessive gene which leads to a shortening of the mandible, the animals being " overshot " (*Fig.* 3). The work was interrupted by the war, and precisely what happens in development to bring about the malocclusion remains uncertain. However, the gene is quite common in long-haired dachshunds and indeed in other breeds of dogs ; people interested in odontological research should thus have no difficulty in securing material for study.

Here I should like to mention the extensive work done by Stockard and his collaborators (1941) on dog hybrids. Orthodontic anomalies galore were produced in their crosses, many of them more extreme than the cases briefly described here. However, the effects, though all of them undoubtedly genetic in origin, have not yet been analysed in terms of genes in the majority of cases ; so the interpretation in terms of developmental physiology will not be simple.

In the cases just discussed, the teeth were quite normal. In so far as orthodontic anomalies developed, these were brought about entirely by growth anomalies of the skull. I have not myself encountered a case yet in which a primary tooth anomaly has led to orthodontic consequences. However, I should like to tell you a little about some work in progress which involves the third molar in the mouse. In itself, the anomaly is trivial, and probably does not influence the fitness of the mouse to any measurable extent.

Though it is a small tooth, the third molar is regularly present in both jaws in most strains of mice. An exception is the pure line Strong CBA, as shown



1 2 3

4 5 6

7 8

Fig. 2.

Development of an orthodontic anomaly in a mutant in the rat. In the normal animals, an elongation of the upper jaw prior to the eruption of the incisors ensures normal occlusion ; the elongation does not take place in the mutant animals which thus either have an edge-to-edge bite, as in *No.* 8, or have the lower incisor tips in front of the upper ones, as in *No.* 6. X-ray photographs of head of normal sib and abnormal, 5 days old (*Nos.* 1, 2), 15 days old (3, 4), 23 days old (5, 6) and 33 days old (7, 8) ; *Nos.* 3 *and* 4 are the same animals as *Nos.* 7 *and* 8. From Grüneberg, 1938, by courtesy of *The Royal Society*.

in *Table* 1 ; here, one or more of the third molars were absent (not impacted) in 61 out of 382 mice (16.9 per cent).

Table 1. Absence of third molars in the mouse.

Strain	*Normal*	*Abnormal*	*Total*
C 57 Black ..	149	0	149
Strong A ..	140	0	140
Strong CBA .	321	61	382

I am obliged to Mr. A. G. Searle for some of the data on the two normal pure lines.

As shown in *Table* 2, both sides are affected about equally frequently, but the lower third molar is involved far more often than the upper one ; also, the upper third molar was affected only twice by itself, the lower teeth being present ; it thus seems as if the involvement of the upper teeth represents a more serious anomaly which is not usually reached without the lower ones being involved first. Altogether, in the 61 affected animals, 79 lower, but only 10 upper third molars were missing.

The genetical analysis of the case is still in its early stages, and the discussion given here should be regarded as preliminary only. The three strains of *Table* 1 were bred simultaneously in the same laboratory under the same conditions. It is thus clear that the anamoly encountered in the CBA pure line is genetically determined. Now, theoretically at least, a pure line should be genetically homogeneous, except for mutations which have arisen recently and have not yet been fixed by inbreeding. Now, are we dealing with a gene for this anomaly which is segregating in the CBA pure line? The evidence is still incomplete, as many of the pairs whose young I have already investigated are still breeding ; and one cannot find out whether a living mouse has all its third molars. The evidence, as far as it goes, does not speak in favour of a gene segregating within the strain. One argument, though indirect, is very powerful. If a gene segregates within

Table 2. Distribution of the anomaly by side and jaw. (A + sign indicates the absence of a tooth).

Upper Jaw		*Mandible*		*Number observed*
right	*left*	*right*	*left*	
—	—	+	—	13
—	—	—	+	20
—	—	+	+	18
—	+	—	—	2
+	—	+	—	3
—	+	—	+	2
+	—	—	+	1
—	+	+	+	2

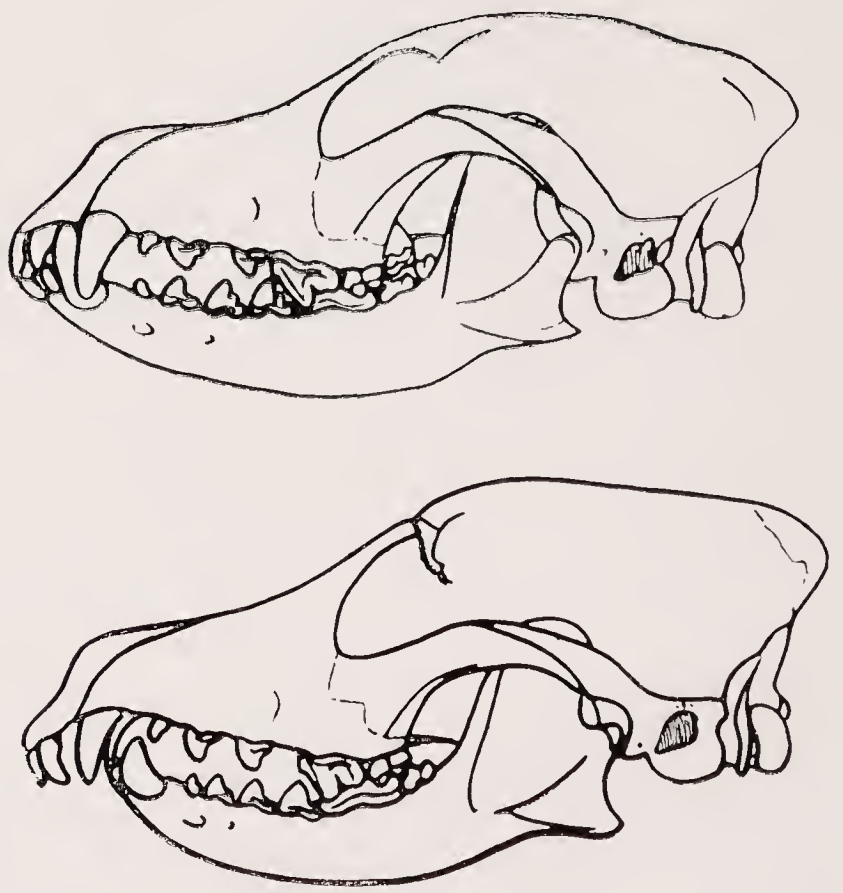


Fig. 3.
Malocclusion in long-haired dachshunds caused by a simple recessive gene. The pathological mechanism leading to the anomaly is not yet known. From Grüneberg & Lea, 1940, by courtesy of the *Journal of Genetics*.

a mating, abnormal animals should occur in successive litters at random ; they should not occur in bunches. Now, bunching is precisely what happens. If the frequency of a character is p, the probability of finding a litter of n animals, all showing the character, is p^n . In our case, the frequency of missing molars is 0.16 ; the probability of finding a litter consisting of 8 abnormals and no normals is thus $(0.16)^8$ or 0.000,000,43 approx. Hence, by chance alone, such a litter should occur rather less than once in 2,000,000 litters of eight young. Now, so far, I have examined only 95 litters, most of them much smaller than 8 young ; yet there have been two litters with 8 affected young, and several less spectacular bunches. Hence, it is quite obvious that the anomaly is precipitated by factors which tend to affect the young of a litter alike ; Mendelian segregation will not do that, and the only factors which can have such an effect are those commonly called the *pre-natal environment*. If this should be confirmed, the situation would be that the animals of the CBA pure line are all alike in having a tendency (realised in about 16 *per cent* of the animals) to lack some third molars as a result of some intra-uterine " accident " which happens in some pregnancies, but not (or to a much smaller extent) in others. This interpretation is further supported by the data of *Table* 3. One can divide the abnormal animals into those which were alone affected in a litter, and those where at least two abnormal animals occurred in the same litter. The " single " abnormals may include a few which were in reality members of a group, as not all the young of a litter have survived to be examined. Nonetheless, it is quite obvious that " singles " are affected less severely than " multiples." This is what one should expect if the anomaly is precipitated by some intra-uterine accident ; if this happens comparatively mildly, only an occasional young in a litter will be affected, and the effect will be slight. But, if the " accident " is more severe, several young will be affected, and the individual anomalies will tend to be more severe.

At this stage, one cannot say whether

Table 3. Severity of the anomaly in litters in which only a single abnormal occurred, and in litters with several affected members.

	Number of molars absent.			
	1	2	3	Mean
Abnormals occurring singly	15	3	1	1.17
Abnormals occurring in groups	20	21	2	1.58
Total	35	24	2	1.46

the anomaly is a property of the mother or of the embryos. In the first case, CBA females would be prone to certain intra-uterine conditions which do not occur, with the same severity at least, in other mouse females. In the second case, the CBA females would not differ from the females of other strains ; but the embryos would be more sensitive and would thus respond to certain intra-uterine conditions which are tolerated by the embryos of other strains. It should be possible to decide between these alternatives experimentally, but this phase of the work has not yet been reached.

The absence of teeth is not the only character which may be influenced by the pre-natal environment. Work in progress in my laboratory suggests strongly that many skeletal variants are similarly influenced. As soon as these factors are properly understood physiologically, these features may be influenced by a proper preventive treatment of the expectant mother. But we are certainly far from this goal yet.

Meanwhile it is as well to remember that not all tooth anomalies are determined in the rather subtle way which seems to govern the third molars in the mouse. Indeed, the present author (1936) has published a human pedigree in which the absence of the same tooth seemed to be determined by a single semi-dominant gene, and there are numerous similar

Fig. 4.

X-ray photographs of halved heads of a grey-lethal (*B*) and a normal litter mate (*A*), 11 days old. From Grüneberg, 1936a, courtesy of *Journal of Heredity*.

Fig. 5.

Tibiae of grey-lethal and a normal litter mate (left), 23 days old. Bone black, cartilage hatched. Note the complete absence of secondary bone absorption as shown by the persistence of spicules throughout the shaft of the bone. From Grüneberg, 1935, by courtesy of *The Royal Society*.

reports for other teeth, notably for the second upper incisors, in the literature. Which of the two types of mechanism is the more common one can hardly be decided at present ; the simple single-gene effect has certainly been published on many occasions ; but most investigators tend to publish the cases which they understand, while they leave the obscure ones in their desk. As critical evidence for intra-uterine effects is exceedingly difficult to obtain in Man, it is not surprising that there are no such reports in the odontological literature as yet.

The importance of secondary bone absorption for the growth of bones and consequently for the establishment of perfect occlusion is too obvious to need much comment. In 1935, I was fortunate enough to discover a mutant in the mouse, called the grey-lethal, which abolishes secondary bone absorption altogether. As the name implies, the gene also has an effect on coat colour which is grey rather than brownish-grey. One of the effects of the gene is that it completely inhibits the eruption of all the teeth ; this seems to be the main reason why the animals die on weaning, as they cannot eat solid food. The lack of secondary bone absorption has another consequence for some of the teeth. The first molars which become encased in their crypts before the growth of the enamel organ is complete find themselves in an unyielding prison as the surrounding bone does not respond to the pressure of the growing tooth ; as a consequence, as the tooth germ does not cease growing, it has to make do with the space available ; this can only be done by assuming a characteristically abnormal shape, as I have described it in 1937. A similar, but much more striking effect is produced in the evergrowing lower incisors ; their rear ends cannot find their way backwards into the condyloid process because their way is barred by unyielding bone ; but, as they continue to grow, they have to force a way out of the mandible in an atypical fashion, and they do this by leaving the lower jaw through the mental foramen where an odontoma is being formed.* (See page 100).

The suspended secondary bone absorption in grey-lethal mice can be used to learn more about the sites at which bone absorption normally takes place, but this is, on the whole, little more than confirmatory evidence to what has been found out about the localities of bone absorption by other methods. What one would really like to know about is the nature and relative importance of the various stimuli which lead to secondary bone absorption in the normal course of events. Some of these stimuli are obvious ; that the growing tooth provides such a stimulus for the dental crypts is, indeed, shown very clearly by the grey-lethal mouse and its tooth anomalies itself. Other causes are by no means so obvious, nor is the grey-lethal mouse the best material to study them. What one really wants is a beast in which bone absorption is only partly inhibited ; in such a case, the strongest stimuli might be expected to be effective, while weaker forces might not succeed ; one should thus be able to arrange the stimuli in order of their effectiveness if such a mutant were available.

Fig. 6.

Lower second molar of normal (*left*) and grey-lethal (*right*) mouse. (*Original*).

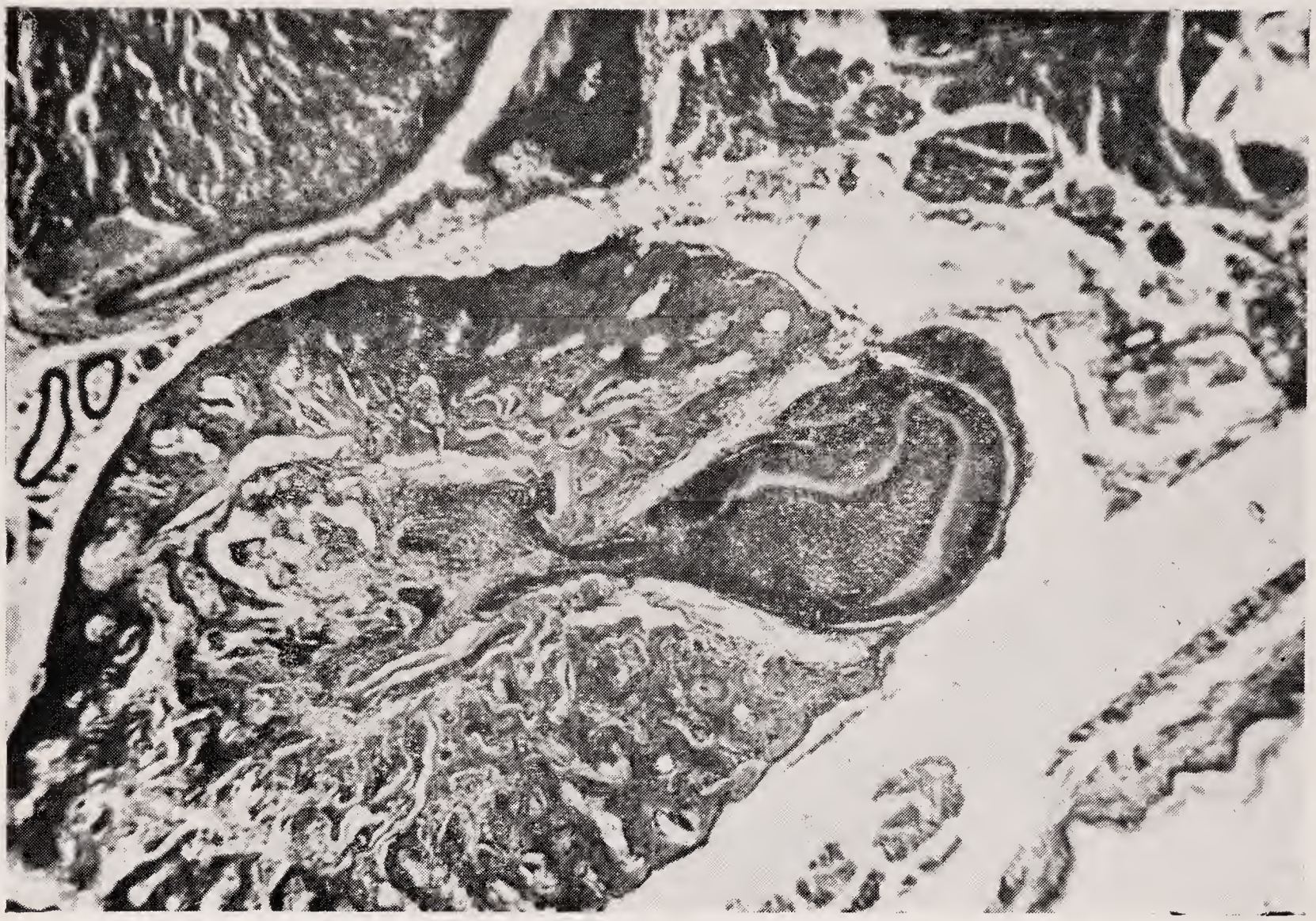


Fig. 7.

Transverse section through grey-lethal mandible (19 days old). The section passes through the mental foramen and shows the rear end of the lower incisor leaving the mandible in this atypical fashion. From Grüneberg, 1935, courtesy of *The Royal Society*.

The second chance in this direction came when Hertwig (1942) described a mutant which had a much stronger effect on coat colour than grey-lethal, making it completely white like an albino, and which also leads to the non-eruption of the incisors. It turned out (Grüneberg, 1948) that the gene in question (which on account of its additional effect on the eye is called microphthalmia) has a very similar effect on the skeleton to that of the grey-lethal mouse. However, the effect is less extreme. While in the grey-lethal no tooth ever erupts, the microphthalmic mouse cuts one or several molars quite often, while eruption of incisors can also happen as a very rare event. Here, then, we seemed to get the desired " incomplete grey-lethal," and its effects on the skeleton have been studied in great detail by one of our students, Mr. Nigel Bateman (unpublished data). Unfortunately, it turns out that the microphthalmic mouse, though less extreme than the grey-lethal mouse, differs from it only very slightly ; the only real difference is that there is enough bone absorption for the eruption of an occasional tooth ; but in the rest of the skeleton, there is scarcely any sign of bone absorption. So we are not much better off than before, and we have to hope for a still more incomplete case of deficient bone absorption.

This chance seemed to come recently, when Grobman & Charles (1947) described a new gene which had a still more extreme effect on coat colour (absence of pigment in the homozygote, but dilution of pigment already in the heterozygote) and which, like Hertwig's microphthalmia, had a reduction of the size of the eye. The situation seemed to suggest that the new gene for White might have a very much weaker effect on the skeleton ;

Table 4. Effects of grey-lethal, microphthalmia and White on coat colour, eyes and skeleton.

	Coat colour	*Eyes*	*Skeleton*
grey-lethal	+	—	+ + +
microphthalmia	+ +	+	+ +
White	+ + +	+	?

indeed, the teeth of the animals regularly erupted, and consequently the animals are not handicapped in feeding and are fully viable. However, this has been a disappointment. The skeleton of the White mouse, so far as I can see, is completely normal; perhaps the idea expressed in *Table* 4 was correct, but complete normality of bone absorption had already been reached on passing from microphthalmia to White. Or perhaps the argument which made me examine the skeleton of the White mouse is at fault. In any case, we still lack the type of mildly disturbed bone absorption which will give us the answer about the relative intensity and the nature of the forces which stimulate absorption in the normal course of development.

It is obvious that the kind of data described in this communication has no immediate application to dentistry. Nonetheless, it represents a type of fundamental research which cannot be carried out on the human subject and for that reason may be of some interest in Dental Research.

**A somewhat similar situation, but much later in life, arises with the lower incisor of another mutant in the mouse, called screw-tail (MacDowell* et alii, 1942) *which is prevented from proper movement by a different mechanism. Here, as bone absorption is normal, the rear end of the tooth forces its way out of the mandible by piercing the bone in an atypical position. The case is of considerable interest, but has not yet been worked out in sufficient detail.*

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DISCUSSION

The President said that the paper was a most absorbing one and he would like to congratulate Dr. Grüneberg on the way in which he had given it.

Professor M. A. Rushton said he was sure everyone present was grateful for having had the opportunity to hear Dr. Grüneberg, who was probably the greatest authority on the subject dealt with in the paper.

He hoped Dr. Grüneberg would not feel, if the discussion was short, that his audience had not listened to his paper with the greatest interest.

It was also, he thought, a great satisfaction to the members as orthodontists to learn that there was at least one orthodontic type of abnormality that could definitely be said to be due to something. As a member of the Society for a long time, it had always seemed to him, that there was practically no orthodontic abnormality which could be said to be due to something without a number of qualifications.

In regard to the question of the third molars disappearing, among other interesting statements in his paper Dr. Grüneberg had said that there was a faint chance that at some remote future date it might be possible, in the conduct of pregnancy, to prevent the disappearance of the third molar. Personally he thought that what one wanted to do was just the opposite.

The question of the mental foramen was a fascinating one. Many years ago he had had the good fortune to read Dr. Grüneberg's work on the grey-lethal mouse, and he would strongly advise all the members to read it. In his admirable book the author described many interesting abnormalities of the teeth in the small rodents, including many which he had not had time to mention in his paper. His analysis of the reasons why the grey-lethal mouse did not get its teeth made a fascinating story. He had been fortunate enough to see some of the sections and also the microfilms, and he was sure that all the members would watch with bated breath while Dr. Grüneberg tracked down some other luckless rodent which would complete his delightful story.

Mr. R. D. Emslie said that he could not do justice to the paper, but he wondered whether Dr. Grüneberg had read any of the papers which had been published by Dr. Fosgill and Dr. Wyman on the I. A. rat, so called because the incisors appeared to be absent. They found on X-ray examination that the incisors were not in fact absent but there were large odontome like masses where the incisors would normaly develop, and that they did not show bone absorption *in utero*. Since then they had taken sections and made histological studies of these odontomes, and it was believed that they were caused by the dentine growing in the bone spaces. Owing to the fact that the roof of the crypt was not absorbed, the developing tooth germ seemed to grow in amongst the actual bone and therefore did not erupt. The I. A. rats, although their incisors did not erupt, lived, and, as far as he knew, they had a normal life, provided that they were given a soft diet.

Dr. Grüneberg, replying to Mr. Emslie, said that in the case of the grey-lethal mouse the tooth kept on growing and must get out somewhere, and it got out through the mental foramen.

He had not seen the papers to which Mr. Emslie referred, but he had been in correspondence with the authors and they had very kindly sent him pickled specimens of the I. A. rat, but in each specimen something else was missing and none of them contained the head. He thought there were certain localised positions on the skeleton where bone absorption was deficient, but it was not enough to be certain.

The slide showed a transverse section through the mandible of the grey-lethal mouse. It showed the rear end of the lower incisor pushing its way in between the numerous trabeculae and pushing its way out through the enlarged mental foramen and forming an odontome. When he first saw the odontome he was very puzzled, and he thought it was an extra tooth.

Mr. C. F. Ballard said he thought that similar conditions to those described by Dr. Gruneberg occurred sometimes in human beings. A patient of his had complete failure of vertical development of the alveolar structure distal to the canines in the lower jaw. There was an open bite of an inch between the first permanent molars. The roots of these teeth were obviously curled against the floor of the mandible, so that the teeth had failed to erupt but the roots had continued to form. The patient's sister had the same condition on one side only, and, from the family history, he thought that the patient's mother also had had the same condition.

The members that evening had heard a short communication by Dr. Dockrell dealing with abnormalities of muscle pattern, and Dr. Grüneberg had dealt with the development of skeletal pattern. Stockhardt in his experiments with dogs had investigated the development not only of muscle pattern but also of skeletal pattern and had come to the conclusion that there was genetic control both of the muscle pattern and of the skeletal pattern. From the point of view of orthodontist, he thought that one was just as important as the other.

On the motion of **The President**, the thanks of the meeting were accorded to Dr. Dockrell and to Dr. Grüneberg.

The President said that, owing to the absence of Mr. McKeag that evening, his installation as President of the Society for 1950 would take place at the next meeting, to be held on January 9th.

The meeting then terminated.

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REPORTS OF MEETINGS.

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 10th January, 1949, at 8 p.m. The President, Mr. L. Russell Marsh, occupied the Chair.

The Minutes of the previous meeting, held on 13th December, 1948, were read and confirmed.

The President welcomed the visitors who were present and expressed the hope that they would enjoy the meeting.

The following candidates for membership of the Society were elected by show of hands:—

H. C. Churchill, L.D.S. R.C.S. Eng., 2, Keble Road, Oxford.

B. Oliver, L.D.S., U.Brist., 4, Spencer Hill, Wimbledon, S.W.19.

The President then delivered the following address—

"Multum in Parvo"

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An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 14th February, 1949, at 7.30 p.m. Mr. L. Russell Marsh, President, occupied the Chair.

The Minutes of the previous Ordinary Meeting, held on 10th January, 1949, were read, confirmed and signed.

The President announced that a communication had been received from the Medical Association of Italian Dentists inviting members of the Society to attend the meeting of the Association to be held at Catania, Sicily, from 20th to 24th April and also inviting them to submit papers and demonstrations. Any member who was interested should apply to the Secretary of the Society for further information. A letter would be written to the Association thanking them for their invitation.

He welcomed all the visitors who were present and invited them to take part in the discussions.

Mr. J. R. E. Mills and Mr. Bernard Oliver, who had recently been elected members of the Society, signed the Obligation Book and were introduced to the President, who admitted them to membership.

The following candidate for membership of the Society was duly elected by show of hands:—

Mr. N. F. Bunn, L.D.S. R.C.S. Eng., 49, Sea Road, Bexhill, Sussex.

A Short Communication was then read—"Serial Models of a Case Treated by the Extraction of the Four First Permanent Molars" by Mr. K. E. Pringle.

Followed by a Paper—"Some Observations on the Growth of the Alveolus in Man" By Mr. Russell Logan.

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An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 14th March, 1949, at 7.30 p.m. The President, Mr. L. Russell Marsh, occupied the Chair.

The Minutes of the previous meeting, held on 14th February, 1949, were read and confirmed.

The President welcomed visitors who were present and expressed the hope that they would take part in any discussion which followed the communications.

Five candidates for membership of the Society were elected by show of hands.

The President announced that the agenda for the evening comprised firstly the showing of an Imperial Chemical Industries film entitled "Movement of the Tongue in Speech," to be followed by a short communication entitled "An

At the conclusion of the film, the President expressed grateful thanks, on behalf of the Society, to the Imperial Chemical Industries, and invited discussion.

There being no discussion on the film, the President called upon Mr. H. Chapman to present his short communication.

Mr. H. Chapman then presented his short communication entitled—
" An Unerupted Canine in a Man aged 79 "

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An Ordinary Meeting of the Society was held on Monday, May 9th, 1949, at 8 p.m. Minutes of the previous Meeting were read and confirmed.

The following is a summary of the Demonstrations :

" Some Interesting Cases " by Miss Joan Ritchie.

" Some Orthodontic Procedures " by Miss R. Casely.

" A Band Forming Pliers " by Mr. R. Ernest Rix.

" A Working Model to Aid in Teaching Orthodontic Diagnosis " by Mr. J. H. Hovell.

" Some Cases Treated at Liverpool Dental School " by Mr. J. W. Softley.

" Some Useful Appliances " by Mr. M. A. Kettle.

" Correcting the Results of Early Loss in the Lower Arch " by Mr. J. D. Hooper.

The following Candidates for membership of the Society, who had been approved by the Council, were elected :

Miss D. M. Y. Campbell, Kings College Hospital, S.E.5.

S. B. Taylor, 12, Seaside Road, Eastbourne, Sussex.

H. L. Leech, 15, Phillimore Gardens, Kensington, W.8.

F. Allott, 1, Imperial Drive, N. Harrow.

D. W. Bugg, 1, Imperial Drive, N.Harrow.

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An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 10th October, 1949, at 7.30 p.m. Mr. L. Russell Marsh, President, occupied the Chair.

The Minutes of the Demonstration Meeting held on 9th May, 1949, were read, confirmed and signed.

The President announced that an apology for absence had been received from Professor Stones.

A number of applications, he said, had been received from dental schools in various parts of Europe for back numbers of the Transactions of the European Orthodontic Society, and Miss Smyth would be glad to hear from any members who had spare copies which they would be willing to sell or give.

The following recently elected members were introduced to the President and signed the Obligation Book : Messrs. Frank Allott, Sydney Bourne, D. W. Bugg, J. H. French, H. Lester Leech and E. Velden.

The following candidate was unanimously elected a member of the Society, by show of hands :

Mr. O. Harcourt Godfrey, Croft House, Bourne Hill, Salisbury.

The following short communications were then read and discussed—

" Congenital Absence of Permanent Molars " By Mrs. M. Davies.

" Treating Cases with Removable Appliances " By J. R. Dimock.

" An Apparatus for Lateral Radiography" By Mr. J. D. Hooper.

" A Craniostat and its Uses " By Mr. P. D. Priest.

" Lip Exercises " By Mr. H. E. Wilson.

An Ordinary Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 14th November, 1949, at 7.30 p.m. Mr. L. Russell Marsh, President, occupying the Chair.

The Minutes of the Meeting held on Monday, 10th October, 1949, were read and confirmed, and were signed by the President.

The following candidates for membership of the Society were approved *en bloc* by show of hands :—

D. M. McGibbon, 10, Spen Drive, West Park, Leeds 6.

J. F. S. Rumble, 4, Pembroke Road, Sevenoaks, Kent.

R. D. Ogston, Lyndale, Farnham Lane, Haslemere, Surrey.

Corresponding Members.

R. Y. Norton, 175, Macquarie Street, Sydney, Australia.

J. G. G. Gugny, 20, Rue de Mogador, Paris.

R. X. O'Meyer, 93, Rue de Commerce, Paris, 15eme artt., France.

The President said this was the evening of the Third Northcroft Memorial Lecture. The first Northcroft Memorial Lecture had been read by Prof. Harris, the second by Dr. Lindsay, and now the Society had the great pleasure and honour of hearing Professor R. Selmer-Olsen, who had travelled all the way from Oslo to come here to give a paper. Professor Selmer-Olsen was the President that year of the European Orthodontics Society and he was also a personal friend of a number of members of the British Society.

Professor R. Selmer-Olsen then read the Third Northcroft Memorial Lceture which was entitled —

" The Fixation and Stability of the Teeth in the Jaws with Relation to their Morphology " and which was accompanied by slides.

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ANNUAL GENERAL MEETING.

The Annual General Meeting for the year 1949 was held at Manson House, 26 Portland Street, London, W.1, on Monday, December 12th, at 7.30 p.m. Mr. L. Russell Marsh, President, occupied the Chair.

Apologies for absence were announced from Mr. H. T. A. McKeag, Mr. Harold Chapman and Mr. J. Pilbeam.

The Minutes of the Ordinary Meeting held on November 14th, 1949, were read, confirmed and signed.

The President announced with great regret the death of three members of the Society, Mr. T. B. Patterson, Mr. R. O. Phillips and Mr. N. L. Smallbone.

ELECTION OF OFFICERS AND COUNCILLORS

The following Officers and Councillors for 1950, proposed by the Council, were unanimously elected :—

President	Mr. H. T. A. McKeag.
Immediate Past President	Mr. L. Russell Marsh.
Vice-Presidents	Miss L. Clinch.
	Dr. L. Lindsay.
	Mr. J. Pilbeam.
Secretary	Mr. H. Richards.
Treasurer	Mr. H. Chapman.
Curator	Mr. W. J. Tulley.
Editor	Mr. C. F. Ballard.
Librarian	Mr. A. G. Taylor.
Councillors	Mr. J. W. Softley.
	Mr. K. E. Pringle.
	Mr. J. S. Beresford.

ELECTION OF TWO AUDITORS

On the motion of **The President**, the Honorary Auditors, Mr. S. B. Newton and Mr. T. L. Winn, were re-elected for the ensuing year.

The Secretary read the following letter from Mr. Chapman, the Honorary Treasurer, who was absent through illness :—

" I regret that the doctor thinks it wise that I should not attend the meeting this evening.

The Auditors have set out our financial position over the past six years in the table which accompanies my report and the accounts, and our thanks are due to them for the trouble that they have taken.

It is obvious that income must be increased and/or expenditure reduced. Suggestions to these ends will be welcomed by the Council. I am sure that one of my fellow Councillors will be glad to answer questions.

The Transactions are predominantly our major expense. In this connection I quote from a letter which Mr. Newton wrote to me after he had audited the accounts : " I think it is a good thing to get the statement of accounts into the hands of the members before the Annual Meeting, as then you can talk to an informed meeting, when you will probably point out how near bankruptcy we shall undoubtedly be in two or three years' time if our expenditure continues at the present rate.
Winn and I formed the opinion that each number of the Transactions now costs about 25/- to 30/-, which is a very high proportion of the two guniea subscription, but it is the only strictly orthodontic publication in this country, and its continued publication is a matter of vital importance if we are to hold our position amongst the world's orthodontists. The subscription for the years 1940, 1941 and 1942 was waived.

My apologies to you all for unavoidable absence."

The President said that as Mr. Chapman was not present the Council thought it would be a good plan for the members to reflect upon the matters in question and to discuss them for about half an hour at the beginning of the next meeting, in January, but if any members were prepared to make suggestions now the Council would welcome them.

Mr. S. B. Newton said that he had been one of the Honorary Auditors of the Society's accounts for some years. The financial position of the Society had been gradually becoming worse and worse, and he felt that something must be done in the way of retrenchment. One of the items which he thought ought to be considered was "Refreshments." The Society was now paying 2/- a head for the refreshments after the meetings, and, while it was very nice to have refreshments and a chat, he felt that the expense was too great. He did not see why those who liked to have a cup of tea or coffee after the meetings should not pay for it.

He also thought that the present subscription was not sufficient and that there must be an increase. It might be increased in the case of members living in London and the home counties, the provincial members paying the present subscription.

The Society needed more members, and the present members might be asked to bring other orthodontists into the Society.

It was difficult to do anything at the Annual Meeting in regard to the financial position of the Society, except to make suggestions, and he thought that the Council ought to set up a small Committee to go thoroughly into the financial affairs of the Society.

Mr. R. Cutler, in supporting the remarks made by Mr. Newton, said it should be remembered that finance was inextricably bound up with administration policy.

He gathered that the subscription income was about £750 a year and that the major expenditure was in connection with the Transactions, which cost about £450 a year. It was very doubtful, in his opinion, whether the membership of the Society would continue to increase as it had in past years, and, apart from that, the position was very much worse, if an actuarial review of the membership list was undertaken, than it appeared to be. He would suggest that the Council should go through the membership list and note the date of registration of each member in the Dentists Register, this would give a rough idea of the member's age. As the result of the first World War, the age group 48-55 was missing to some extent from the Dentists Register, and the Dentists Register was decreasing He thought it would be found that the membership of the Society consisted chiefly of men up to about 43 years of age and of men about 69. That meant that in the next few years there might be a rapid decrease in the older age group members, by retirement or natural causes.

In regard to an increase in the subscription rate, he thought that might be dangerous. To take two analogies, the cost of spirits and the cost of cinema seats, it had been found that both those were at saturation level and if either was raised the consumption tended to fall. He thought it might be found that an increase in the subscription rate would result in resignations and fewer new members coming into the Society. The matter should be very fully considered before any increase was made.

If the income could not be increased, the question to be considered was how the expenditure could be reduced, and in that connection he thought the first thing to decide was where economies should not be made. In his opinion, no economy whatever should be made in regard to the Transactions, which was the chief link with the members all over the country, whether they came to the meetings or not. The cost of the Transactions was bound up with cost of the reporting, it was a considerable item but could not be dispensed with. Again, he did not think that there should be any economising in printing, postages, because the communications which were sent to the members about the activities of the Society formed another link with all the members. Moreover, he did not think

there should be any saving in expense whereby the work of the honorary officers of the Society could be reduced, such as the purchase of a typewriter. In order to lessen their work, money should be freely expended. The items which he had mentioned were those in regard to which no economy should be tolerated.

In regard to the items where economy should clearly be exercised, Mr. Newton had already mentioned refreshments ; he was in complete agreement with him in that respect, because the members who attended the meetings were being subsidised by those who did not come and by those who found it quite impossible to come, as was shown by the fact that the Transactions at 30/- and refreshments at 2/- after each meeting came to more than the subscription. The members who did not attend the meetings required even more encouragement than those who did, and he thought that the cost of the refreshments should be borne and gladly borne by the members who came to the meetings.

The next point was the question whether a precedent had been created by giving honorariums to speakers at meetings. There were certain cases in which an honorarium was perhaps desirable, but he would not like it to be established as a precedent, so that an annual sum taken from the subscription income was devoted to this purpose.

The question whether the number of meetings should be reduced if sufficient good material was not available should be considered, because for the bulk of the membership the benefit would be equally great if a contributed article of high quality, which had not been read before the Society, was published in the Transactions.

Some encouragement might be given to the sale of the Transactions in America and the British Commonwealth. That was a point which had been considered before, when there was some question of the Society having a publishing house in this country to handle the Transactions. The publisher in question then had referred to the contacts that he had with publishing houses in America, and probably the publisher of *The Dental Record* had the same sort of contacts. If contacts were made with publishing houses in the Commonwealth and in America, it might be possible to sell a block of Transactions, which would decrease the net cost to the Society.

Mr. Glass suggested that the Transactions, which appeared to be the main item of expenditure, should be separated from the subscriptions, because books of academic interest could be obtained free of tax, whereas the subscription to the Society was not free of tax.

The President said that subscriptions to professional Societies were tax free.

Mrs. Michaelis said that in the current Transactions of the Royal Society of Medicine there was a notice from Somerset House authorising that.

Mrs. Mountford said that did not apply to members in local government service.

The discussion was then, on the suggestion of **The President,** adjourned to the next meeting.

The reports of the Hon. Treasurer, Secretary, Librarian, Editor and Curator were then read and adopted, as follows :—

REPORT OF THE TREASURER

Since 1943 the Publication and Printing of the Society's Transactions has taken place some time after the end of the year to which they applied, this has meant that it has not been possible to include an accurate figure for the cost of the Transactions in the Accounts for the respective years, and due to the increasing costs each year, the estimated cost which has been charged in the Accounts, has subsequently been found to be inadequate, necessitating the charge made in this year's Income and Expenditure Account to be very high to cover the under reserves of previous years.

As the cost of the Transactions is by far the largest item in the Society's Accounts, this under reserving has led to rather misleading balances having been shown on the Income and Expenditure Accounts for the years 1943/49, and, therefore, for the information of members there is set out on page 4 a table showing the corrected surpluses and deficiencies for these years,

after charging the actual or revised estimated cost of the Transactions to the following 31st December of each year.

A memorandum column showing the subscriptions received in these years is also included in the table, which shows the high proportion of the subscription which is now expended on Transactions. The case of the 1946 Transaction being 24/9d. per volume and the 1947 Transactions 33/- per volume.

(*See back page for analysis.*)

NOTES:

(*a*) *This item is made up of the cost of Transactions* 1942/43 (*one volume*) £120.18.7 *half this amount* £60.9.3 *being applicable to* 1942, *and* £32.1.11 *for previous years Transactions, making a total of* £92.11.3 *for previous year and* £60.9.3 *for* 1943.

(*b*) *The Transactions* 1944 *and* 1945 *were published in one volume for the two years, the cost is, therefore, split between these two years.*

(*c*) *The costs of Transactions in this year were abnormally high because type was set up specially to conform to that of previous issues, but to reduce the costs, future issues will have the same format as the present Dental Record.*

(*d*) *These are estimated figures.*

(*e*) *Subscription increased from* £1.1.0 *to* £2.2.0 *in this year.*

(*f*) *In May* 1949, *the Council approved the expenditure of* £30 *on books for the library, but as none of these had been paid for in the year, this item will be included in the Accounts to* 30*th September*, 1950.

The value of the investments is shown in the Balance Sheet as £975.14.0 from which £395.15.10 would be required to meet reserved expenditure to 30th September, 1949. The bank balance includes £405.4.2 the amount of the uninvested portion of the realisation of Savings Certificates in 1947.

These two items total £801 withdrawn, or to be withdrawn from investments to meet the excess of expenditure over income since 1944.

The Society is fortunate in having these investments, built up over the years since the Society's formation, to draw upon, but obviously the Society must meet its current expenditure from current income; the council is considering what action to take to ensure this.

One of our Hon. Auditors (Mr. S. B. Newton) writes: " ..... how near bankruptcy we shall be in two or three years if our present rate of expenditure continues."

REPORT OF THE SECRETARY

The programme for the current year has been completed as arranged by the Council. Seven meetings have been held, with an average attendance—up to and including the November meeting—of 70.

Twenty two new members have been elected and there have been thirteen resignations. Certain names have been deleted for non-payment of subscriptions, and the total membership is now 340.

A new list of members has been compiled which included all those elected this year, and this will be published within the next few days.

There has been an occasional slight difficulty in impressing upon the printers the importance of changed addresses, but in the absence of any recent complaints from members it is hoped that the addresses on the new list are correct. The list will be circulated to members with the agenda for the Januray meeting, together with the programme for 1050.

I would like to record my thanks to Mr. Pringle, our Secretary up to December 1948, for his help during this year, and to Mr. Harold Chapman for his advice on many points which have arisen.

The staff at Manson House, have also been most co-operative in making arrangements for meetings.

The attendances promise well for the future of the Society and the high standard of the papers given is reflected in the enthusiasm of the members.

REPORT OF THE LIBRARIAN

Borrowings

The library has been used to a greater extent than last year, but not so much as in the record year, 1947.

New Books

For the first time in many years an attempt has been made to bring the

library up to date. The following books have been acquired by gift and purchase :

Anderson, George M.	Martin Deweys' Practical Orthodontics.
Bjork, Arne.	The Face in Profile — an anthropological X-ray investigation on Swedish children and conscripts.
Brash, Prof. J. C.	The Aetiology of Irregularity and Malocclusion of the Teeth
Chapman, Harold.	Orthodontics : A Chapter from a Textbook.
Colyer, Sir Frank	Abnormal Conditions of the Teeth of Animals in their Relationship to Similar Conditions in Man.
Fawcett, Brash. Northcroft & Keith	The Growth of the Jaws, Normal and Abnormal, in Health and Disease.
Hellen, Margit	Anthropological Investigations of the Distances from the Alveoli of the Molars to Porus Acusticus Externus respectively to the Condyloid Process as well as a Similar Investigation of the Molar Alveolar Widths.
McCoy, James David	Applied Orthodontics.
Murray, P. D. F.	Bones, a Study of the Development and Structure of the Vertebrate Skeleton.
Oliver, Irish & Wood	Labio-lingual Technic.
Salzmann , J. A.	Principles of Orthodontics.
Schrodinger, Erwin	What is Life ?
Sicher, Harry	Oral Anatomy.
Smyth & Young	Facial Growth in Children, with special reference to dentition.
Spencer, Paul Guy	Prevention of Malocclusion.
Weinmann & Sicher	Bone and Bones, Fundamentals of Bone Biology.
Widdowson, T. W.	Special or Dental Anatomy and Physiology and Dental Histology.
Young, Johnson Smyth & Still	Investigations into the Nature and Characteristic Features of Post-normal Occlusion.

Journals

The Society subscribes to or receives the following periodicals :

Journal of the American Dental Association.
The Angle Orthodontist.
American Journal of Orthodontics.
Archives of Orthodontics.
Bulletin of the Pacific Coast Society of Orthodontists.

Thanks

The thanks of the Society are specially due to Miss K. C. Smyth and Mr. Harold Chapman for gifts of books and periodicals.

Index

An index of the contents of the library is in an advanced stage of preparation and it may be published in the near future.

REPORT OF THE EDITOR

As I have only been in office one year there is very little for me to report. The Dental Record editors have been very co-operative in publishing papers read before the Society, and this, it is hoped will expedite the publication of the Transactions. Unfortunately, one small illustration has been printed upside down. This apparently is very difficult to avoid because of the slackness of the people working the printing presses. They are liable to remove blocks for adjustment and not be particularly careful in replacement. This was the cause of the error in question.

As you know, the 1946 Transactions were distributed two months ago.

Mr. Pilbeam wishes me to give you the following Report on the previous year's Transactions.

It was hoped that during the year the Transactions for 1946 and 1948 would be published, but it has only been possible to complete those for 1946. As regards the 1948 Transactions the proofs have only been received today. They will not therefore, be available to members before the early part of February. Once this leeway in the Transactions has been made up members should receive them more regularly, probably not later than April in each year.

During the last seven years there has been a number of serious set backs. The Transactions were originally published by the Dental Manufacturing Company and in 1942 the printers' premises were bombed. Owing to the shortage of staff during the war, it was difficult to find new printers to take over the work. In all, three printers were approached but no satisfactory arrangements could be made and this, coupled with the extreme paper shortage, caused delay after delay which has not yet been completely resolved. The Dental Manufacturing Company finally disposed of the Dental Record to Messrs. Saward & Co.

who, for the last few years, have printed the Transactions. The work was new to them and it has taken them some time to become conversant with the difficulties in the preparation of a scientific and intricate publication. The experience gained, however, will stand them in good stead for the publication of future Transactions.

The 1946 Transactions were the last to be printed in the old convenient format. Those for 1948 are to be printed in double columns, which is the lay-out for the Dental Record. This decision was made by the Council in order to save expense through re-setting type. All papers read before the Society in 1948 were published in the Dental Record so that the same type has been used for the Transactions. Accordingly, as from 1948 they will be slightly larger than previously and the pagination will be less.

Several innovations have been tried during the last few years which it is hoped have met with the members approval. These were the incorporation of an index, a list of past principal officers of the Society and a section dealing with notes, to readers.

In my opinion, Messrs. Saward have maintained a high standard of publication and this, together with the excellent papers read before the Society, have made the Transactions eagerly sought after by orthodontists both here and abroad.

I should like to express my grateful thanks to Dr. Lindsay for so kindly and efficiently preparing the index to the Transactions for the years 1946 and 1947 which formed such an important and valuable reference for the convenience of members. I have also to thank her for her valuable suggestions and corrections.

Finally, I should like to thank the Council of the Society and members for their patient attitude and understanding in the difficulties which have been encountered in publishing the Transactions during the last seven years.

REPORT OF THE CURATOR

Members are reminded that the Museum, housed at 28, Portland Place, W.1, is open from 9.30 a.m. to 5 p.m. Thanks are due to Miss L. Clinch, Mr. R. Grewcock and Professor S. Friel for specimens given during the year. The collection of portraits of past presidents of the Society, tenaciously pursued by Miss Clinch, is now almost complete. One or two of the more recent presidents have not yet sent in their portraits. Miss Clinch has kindly provided an album for the collection.

ELECTION OF AN HONORARY MEMBER

Dr. Lindsay proposed, on behalf of the Council, that Miss C. Johanson, of Palkane, Birka, Finland, be elected an Honorary Member of the Society. Miss Johanson, she said, had been a very faithful member of the Society for many years, and her election as an Honorary Member would be an honour to the Society as well as to her.

The motion was carried unanimously.

Visitors were then admitted to the meeting, and **The President,** in welcoming them, said that he hoped they would consider themselves members for the evening and take part in the discussions.

ELECTION OF MEMBERS

The following candidates for membership were elected by show of hands :—

S. F. Fish, 7, Audley Road, Saffron Walden, Essex.

E. J R. Bird, 67, Wimpole Street, W.1.

The following short communication was then read—

" A Case of Micrognathia and Microglossia " By Dr. R. B. Dockrell.

The following paper was then read—

" Animal Genetics and Orthodontics " By Dr. Hans Grüneberg.

* * * * *

INCOME AND EXPENDITURE ACCOUNT

AND

BALANCE SHEET

for the Year ended 30th September, 1949

INDEX

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

INCOME AND EXPENDITURE ACCOUNT for the Year ended 30th September, 1949.

1948 £ s. d.		£ s. d.	£ s. d.
10 10 0	To Storage Rent	10 10 0	
55 4 11	,, Printing and Stationery ..	58 16 10	
	,, Transaction	299 12 6	
252 14 6	,, Reserve for Cost of Transactions	705 0 0	
			1,063 9 4
22 14 8	,, Postage	.. ..	26 11 10
6 0 0	,, Lantern and Film Expenses	3 17 6	
45 0 0	,, Hire of Hall	45 0 0	
29 8 0	,, Reporting	31 10 0	
53 0 0	,, Refreshments	55 0 0	
5 6 0	,, Lighting Demonstration Meeting	— — —	
			135 7 6
4 4	,, Telephone and Telegrams ..	.. ..	7 11
4 6	,, Travelling Expenses ..	.. ..	5 3
5 5 0	,, Audit and Accountancy	.. ..	5 5 0
3 4 6	,, Insurance	.. ..	3 4 6
2 8 0	,, Journals—American Dental Association	2 8 0	
	Anglo Orthodontist ..	5 9 0	
	Archives of Orthodontics	1 15 3	
	McCoy Applied Orthodontics	1 12 3	
			11 4 6
10 10 0	,, Legal Expenses		— — —
10 10 0	,, Presentation Mrs. Phebey		— — —
	,, Northcroft Memorial Lecture—		
26 5 0	Honorarium—Dr. Lilian Lindsay ..		26 5 0
14 19 0	,, Printing		— — —
1 0 6	,, Sundries		1 12 0
30 11 6	,, Depreciation—Furniture and Office Equipment		30 11 6
136 13 5	,, Excess of Income over Expenditure for year to date		— — —
£721 3 10		£1,314 14 4	

1948 £ s. d.		£ s. d.	£ s. d.
	By Members' Subscriptions—		
691 8 6	,, 1949 Subscriptions ..	708 19 11	
	,, 1948 Subscriptions paid 1949	25 4 0	
			734 3 11
	,, Special Contribution to General Fund ..		1 1 0
	,, Sales of Transactions		31 5 0
12 10 0	,, Accrued Interest on Savings Certificates		12 10 0
17 4 5	,, Interest on 2½% Consolidated Stock ..		17 5 4
— — —	,, Excess of Expenditure over Income for year to date		518 9 1
£721 3 10		£1,314 14 4	

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

BALANCE SHEET as at 30th September, 1949.

1948									1948								
£	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
			Accumulated Fund :—										*Furniture and Office Equipment* :—						
1,481	9	4	Balance at 1st October, 1948	1,618	2	9				580	18	6	Balance at 1st October, 1948	550	7	0			
			Add Excess of Income over																
136	13	5	Expenditure for year to date							30	11	6	*Less* Depreciation at 5% per annum on cost	30	11	6			
1,618	2	9	*Less* Excess of Expenditure over Income for year to date	518	9	1											519	15	6
							1,099	13	8				*Debtors* :—						
			Creditors :—							13	13	0	1949 Subscriptions received since 30th September, 1949				7	7	0
950	19	6	Transactions 1946 ..	355	0	0							*Investments* :—						
			Transactions 1948/49 (Estimated by Hon. Treasurer)	800	0	0				375	0	0	500 National Savings Certificates, seventh issue at cost	375	0	0			
			Journals	3	11	3				12	10	0	*Add* Accrued Interest to date	25	0	0			
9	17	4	Printing and Stationery ..	—	—	—								400	0	0			
22	10	0	Hire of Hall	22	10	0							£691 5*s.* 10*d.* 2½% Consolidated Stock at cost ..	574	15	0			
7	17	6	Storage Rent	7	17	6				575	14	0	(Market Value — £901 9*s.* 0*d.*)				975	14	0
10	0	0	Refreshments	11	0	0				1,104	14	2	*Cash at Bank*				906	3	9
2	2	0	Transactions sold in advance	—	—	—							*Cash in Hand* :—						
8	18	6	Subscriptions in advance ..	9	9	0				3	6	10	Hon. Treasurer				3	5	
5	6	0	Sundries	—	—	—					8	7	Hon. Secretary				—	—	—
							1,309	7	9										
			Petty Cash :—																
			Overdrawn (Hon. Secretary)					2	3										
£2,635	13	7					£2,409	3	8	£2,635	13	7					£2,409	3	8

S. B. NEWTON
T. L. WINN } *Hon. Auditors.*

HAROLD CHAPMAN, *Hon. Treasurer.*

Certified in accordance with the Books and Vouchers of the Society.
We have verified the Investments and Cash at Bank.

Fredk. B. Smart & Co.,
Chartered Accountants.
22, Queen Street,
London, E.C.4.

2nd November, 1949.

1	2		3	4		5	6		7
Year to 30th September	Balance per Accounts		Amount charged for Transactions in the year	Balance excluding Transactions		Corrected Amount to be charged for Transactions for the year	Actual Balance		Subscriptions Received per the Accounts
	Surplus	Deficiency		Surplus	Deficiency		Surplus	Deficiency	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1943	61 3 3	– – –	32 1 11	93 5 2	– – –	153 0 6 (*a*)	– – –	59 15 4	185 16 0
1944	132 1 4	– – –	– – –	132 1 4	– – –	56 7 3 (*b*)	75 14 1	– – –	264 12 0
1945	– – –	82 6 11	120 18 7	38 11 8	– – –	56 7 3 (*b*)	– – –	17 15 7	225 3 6
1946	– – –	210 17 1	300 0 0	89 2 11	– – –	408 18 5	– – –	319 15 6	264 10 0
1947	– – –	394 7 9	400 0 0	5 12 3	– – –	535 14 1 (*c*)	– – –	530 1 10	328 13 0
1948	136 13 5	– – –	252 14 6	389 7 11	– – –	450 0 0 (*d*)	– – –	60 12 1	691 8 6 (*e*)
1949	– – –	518 9 1	1004 12 6	486 3 5	– – –	450 0 0 (*d*)	36 3 5 (*f*)	– – –	734 3 11
	329 18 0	1206 0 10	2110 7 6	1234 4 8	– – –	2110 7 6	111 17 6	988 0 4	2694 6 11

INDEX

Page

Aborigines, Australian 74
Absence, congenital, of permanent molars 53
Adams, C. P.
The Modified Arrowhead Clasp 50
Adaptation, functional 93
Age problem 20
Agnathia 91
Alveolus, growth of 27
Anchylosis 29
Anodontia, partial 53
Apron Spring, modification of 42
Arrowhead Clasp, modified 50
Band Forming Pliers 48
Canines, unerupted 36
Caseley, Rosamund
Some Orthodontic Procedures 46
Cephalostats 61, 63, 65
Cercopithecus aethiops 85
Chapman, H.
An Unerupted Canine in a Man Aged 70 36
Craniostat 65
Davies, Muriel E. H.
Congenital Absence of Permanent Molars 53
Dimock, J. R.
Treating Cases with Removable Appliances 57
Dockrell, R. B.
A Case of Micrognathia and Microglossia 90
Extraction of the Four First Permanent Molars 23
Exercises, Lip 68
Fixed Appliances 38
Fixed Point in phantom socket 30
Friel, Professor S.
Opening Discussion on Professor Selmer-Olsen's Paper 84
Genetics, determination of vertical dimension 27
,, animal, and Orthodontics 93
Growth of Alveolus 27
Gruneberg, Dr. Hans
Animal Genetics and Orthodontics 93
Hooper, J. D.
Correcting the Results of Early Loss in the Lower Arch 38
An Apparatus for Lateral Radiography 61
Hovell, J. H.
A Working Model to Aid in Teaching Orthodontic Diagnosis . . . 42
Inclusion of deciduous molars 29
Inter-maxillary Tubes, Apparatus for lining up and soldering 52
Kettle, M. A.
Three Demonstrations 39
Krapina Teeth 81, 87
Lapps, morphology of their teeth 72
,, origin of race 72
Liverpool Dental School, demonstration by 50

Logan, W. Russell
Some Observations on the Growth of the Alveolus in Man . . . 27
Discussion on Professor Selmer-Olsen's Paper 86
Margolis, Professor H. I.
Lateral Radiography 63
Marsh, L. Russell
Multum in Parvo 13
Mice, CBA strains 94
,, grey-lethal 98
Micrognathia 90
Microglossia 90
Model Trimmer 52
Molars, congenital absence of permanent 53
,, deciduous, correcting the results of early loss of 38
,, forward movement of 32
,, four first permanent, extraction of 23
,, temporary, submerged 27
Morphology of Teeth 72
Multum in Parvo (L. Russell Marsh) 13
Muscle Action 68
Mutations 86, 99
Northcroft, The Third Memorial Lecture 72
Oligodontia 53
Orbicularis Oris 68
Phantom socket 30
Porter, Lowrie, modification of the appliance of 39
Priest, P. D.
A Craniostat and Its Uses 65
Pringle, K. E.
Serial Models of a Case Treated by the Extraction of Four First Permanent Molars 23
Psychology (Habits) 16
Radiography, Apparatus for Lateral 61, 65
Ritchie, Joan
Some Interesting Cases 42
Rix, R. Ernest
Band Forming Pliers 48
Rushton, Professor M. A.
Discussion on Professor Selmer-Olsen's Paper 87
Selmer-Olsen, Professor R.
The Fixation and Stability of the Teeth in the Jaws with Relation to their Morphology 72
Serial Models 23
Sinanthropus Pekinensis 73
Softley, J. W.
Forward Movement of Molars 32
Lead Sealing Pliers adapted for making Orthodontic Attachments . 52
Stones, Professor H. H.
Vote of Thanks to Presidential Address 21
Taurodontism 81
Treatment with Removable Appliances 57
Unerupted Teeth, appliances for alignment of 41
Vertical dimension, genetic determination of 27
Wilson, H. E.
Lip Exercises 68
Wire Dispenser 52